

AR26

A prime U.S. need:  
to stimulate a turnaround in  
business investment



For the year January 1-December 31, 1976

**1040 U.S. Individual Income Tax Return**

For the year January 1-December 31, 1976

Mr. & Mrs. John Doe

First name and initial (if joint return)

100 Main Street

Present home address (No. and street)

Centerville

City, town or post office

Interest in equity securities owned or controlled by the taxpayer

Authorized stock (\$1 par value) 230,368.572 shares issued 1976

Common stock (\$2.50 par value) 100 shares issued 1975

Long-term borrowings

Amounts received for stock in exchange

**Retained earnings**

Amount common stock held in treasury

Share owners' equity

**100 SHARES**



# General Electric 1977 Annual Report

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**The cover:** the interacting elements of capital formation that create jobs for more American workers by increasing their productivity. Recognizing that opportunities for General Electric — as for all business — depend on a vigorous and healthy economy, GE managers in 1977 reiterated their belief that the U.S. lag in business investment is a primary cause of such critical economic problems as inflation, unemployment, lost economic momentum and a moribund stock market. The solution suggested by the interlocking cogs on the cover: tax revisions that benefit investors and that strengthen the ability of business to generate earnings retained for investment in more productive, job-creating facilities and equipment.

## Transfer Agents

General Electric Company  
Securities Transfer Operation  
570 Lexington Avenue  
New York, New York 10022

The First National Bank of Boston  
Shareholder Services Division  
P.O. Box 644  
Boston, Massachusetts 02102

**Note:** Unless otherwise indicated by the context, the terms "GE", "General Electric" and "Company" are used on the basis of consolidation described on page 36. Unless otherwise indicated by the context, the terms "Utah" and "Utah International" mean Utah International Inc., as well as all of its "affiliates" and "associated companies" as those terms are used on page 36.

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**Editor:** Frederick N. Robinson

**Associate Editors:** Devere E. Logan; Edna Vercini

**Financial Editor:** Sidney D. Spencer

**Art Direction:** Jack Hough Associates, Inc.

**Cover Concept:** Leonard Wolfe

**Editorial Board:** David W. Burke, *Manager, Corporate Communications*; J. Hervie Haufler, *Manager, Corporate Editorial Programs*; John L. Ingersoll, *Manager, Corporate Institutional Relations*

**Photographers:** Chris Anderson, Stan Blanchard, Joseph Brignolo, Gary Calderwood, Arthur d'Arazien, Walter B. Halstead, Ty Hyon, Tony Kelly, Russell Ley, Dan Montross, Fujio Nakahashi, Lance Nelson, Carl Weese

# Financial highlights

(Dollar amounts in millions; per-share amounts in dollars)

For the year	1977	1976	Percent increase
Sales of products and services to customers .....	\$17,519	\$15,698	12%
Other income .....	390	274	42
Total revenues .....	17,909	15,972	12
Net earnings applicable to common stock .....	1,088	931	17
At year end			
Short- and long-term borrowings .....	\$ 2,056	\$ 1,933	6%
Share owners' equity .....	5,943	5,253	13
Total capital invested .....	8,131	7,305	11
Measurements			
Net earnings per common share .....	\$ 4.79	\$ 4.12	16%
Dividends declared per General Electric common share .....	2.10	1.70	24
Operating margin as a percentage of sales .....	9.7%	9.7%	
Earnings as a percentage of sales .....	6.2	5.9	
Percent earned on average share owners' equity .....	19.4	18.9	
Percent earned on average total capital invested .....	15.8	15.1	
Borrowings as a percentage of total capital invested .....	25.3	26.5	

Operating results by industry segment	Revenues			Net earnings		
	1977	1976	Percent increase (decrease)	1977	1976	Percent increase (decrease)
Consumer products and services .....	\$ 4,148	\$ 3,453	20%	\$ 256	\$204	25%
Industrial products and components .....	3,698	3,270	13	191	160	19
Power systems .....	3,218	2,998	7	75	61	23
Technical systems and materials .....	4,145	3,688	12	248	202	23
Utah International Inc. ....	965	1,003	(4)	196	181	8
Foreign multi-industry operations .....	2,562	2,334	10	71	75	(5)
General Electric Credit Corporation .....	67	57	18	67	57	18
General corporate items and eliminations .....	(894)	(831)		(16)	(9)	
Total Company .....	<u>\$17,909</u>	<u>\$15,972</u>	12	<u>\$1,088</u>	<u>\$931</u>	17

The results by industry segments here and throughout this Report reflect the Company's organization into Sectors in 1977. Additional information about industry segments is presented on pages 44 and 45.

Operating results by geographic segment	Revenues			Net earnings		
	1977	1976	Percent increase (decrease)	1977	1976	Percent increase (decrease)
United States .....	\$14,560	\$12,879	13%	\$ 846	\$633	34%
Far East including Australia .....	1,056	1,040	2	162	195	(17)
Other areas of the world .....	2,917	2,565	14	83	104	(20)
Elimination of intracompany transactions .....	(624)	(512)		(3)	(1)	
Total Company .....	<u>\$17,909</u>	<u>\$15,972</u>	12	<u>\$1,088</u>	<u>\$931</u>	17

Additional information about geographic segments is presented on page 45.

As used in this Report, "revenues" consists of sales of products and services to customers and other income from external sources.

## The Chairman comments

**"In 1977, General Electric's earnings exceeded \$1 billion for the first time, and our quarterly dividend rate was raised to 55 cents per share. We further strengthened our management system. To improve the U.S. economic outlook, we urge policies that will encourage an upturn in business investment."**

A fundamental objective of General Electric's management is to sustain high rates of earnings and dividend growth, achieved in ways that earn the approval and support of the societies we serve. In 1977, we passed a significant milestone in our quest of this goal: this was the first year in which our after-tax earnings exceeded \$1 billion.

The year's 17% increase brought our net 1977 earnings to \$1,088 million, or \$4.79 per share. Your Board of Directors translated the year's positive performance into a more favorable return to share owners when, in May, they increased the quarterly dividend rate from 45 to 55 cents per share. Combined with the increase in September 1976, this latest improvement means that the rate of quarterly payments to you has risen 38% in less than two years. Some 40,000 of you began in 1977 to use the new Dividend Reinvestment Plan to increase your holdings of General Electric stock.

The Company's sales in 1977 were up 12% to \$17.5 billion. These higher sales, together with strong operating margin rates, contributed to the increase in earnings. In addition, other income from a variety of operating and nonoperating sources was well ahead of that for 1976. The year's improved results are a tribute to our managers and all GE people who continued their vigorous programs aimed at achieving better cost/price ratios and productivity improvements.

These dedicated efforts helped the Company continue to improve its operating results and strengthen its financial position. The ratio of net earnings to sales was 6.2%, up from 5.9% in 1976. Our return on share owners' equity increased to 19.4%, compared with 18.9% in 1976, and return on average capital invested rose to 15.8% from 15.1%.

Our financial strengths provided the resources to finance future growth. Additions to plant and equipment were a record \$823 million, 11% above the 1976 outlays. Research and development ex-

penditures reached a new high of \$1,156 million, reflecting increases both in Company-funded projects and in R&D work performed under contract.

**Strategies for growth:** For several years we have been reporting to you on the use of our strategic planning system to identify the strongest growth opportunities for General Electric and to guide management in allocating the Company's resources to provide full support for our operations in these selected growth areas.

A reading of the operating reviews that follow in this Annual Report will point up several key ways in which the strategic allocation of GE interests and resources is bearing fruit, enabling your Company to achieve growth that exceeds that of the U.S. economy as a whole:

- By careful selectivity in resource allocation, we are broadening the sources of GE earnings growth. In 1977, as an example, we again saw some 40% of earnings deriving from the sales of materials and services rather than equipment. Further strong profitable growth was realized in our high-performance plastics and other man-made materials, in the broad financial services offered by the General Electric Credit Corporation, in our information services network, and in our worldwide apparatus installation, maintenance and repair services. Utah International, completing its first full year as a wholly-owned affiliate, has added the dimension of natural resources, an area of great potential in a world that is industrializing and pressing against finite supplies of raw materials.

- Even in equipment manufacture, some of our most impressive growth opportunities are in businesses that have been spun off from our traditional electrical businesses — into new forms of health care, advanced types of communications equipment, and gas turbine technology applied to air, sea and industrial power uses.

- At the same time, we have expanded



selectively in international markets, a number of which are growing faster than U.S. markets. Risks in international investments have been minimized by the strategic planning our managers have applied and by their concentration on exports of high-technology equipment and industrial systems needed by countries in developing their infrastructures.

- These objectives are being realized even as we continue to develop our traditional core businesses, structured around electric power and its utilization. Nearly all of these businesses are solid money-makers, as demonstrated by the 1977 performance in appliances, lighting and industrial products.

As a result of these positive factors, we believe General Electric is positioned to transcend the parameters of its U.S. base and its origins in core electrical technologies and to exceed the general expansion of the United States economy.

**Operational reviews** in this Annual Report have been realigned to correspond to the new six-Sector organizational structure that was put in place at the end of 1977.

This structure is based on a four-year study to determine what evolutionary changes would be needed in our organization and management system to prepare the Company for the 1980s. Organization into six operating Sectors provides effective management and planning at the top level, while also meeting the primary objective of giving us a structure that is sufficiently broad in scope to accommodate the growth we foresee without requiring additional basic restructuring.

In addition, we have changed our corporate staff structure with the aim of improving the Company-wide management of our basic strengths in such areas as human and production resources, finance and technology.

Of the key executives assigned, some continue in their familiar positions, while others have moved into new areas of ex-

perience. This balance of continuity and manpower development is expected to provide a broadly experienced and well-balanced managerial team to lead the Company in the 1980s.

It has been part of our planning to make these moves at this time when our economic health is good and our operations are staffed with strong and experienced managers who can absorb the changes while keeping the Company functioning smoothly. We look to this new management system to keep General Electric profitable, manageable and responsible into the 1980s.

**The outlook:** 1978 has, from our viewpoint, started well. With the U.S. economy now three years into the recovery, we at GE have a strong orders backlog and are seeing an encouraging flow of new orders.

One main element that is required to sustain and extend U.S. economic recovery is emphasized on the cover of this Annual Report: the need for the U.S. to stimulate a turnaround in business investment. The lag in capital spending by business is, in our view, a problem that is central to the other basic problems facing the U.S. economy — unemployment, inflation, low rates of productivity improvement, substantial deficits in the U.S. trade balance, and a stock market that reflects investors' uneasiness about the future.

Businessmen do not hold back from capital investment by preference but out of a sense of stewardship for the resources entrusted to them. As responsible stewards, businessmen today frequently have no choice but to withhold plant investments because the economic risks and uncertainties so greatly outweigh the potential for adequate return.

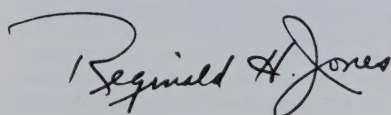
A big source of uncertainty affecting both business and consumer confidence is the size and shape of the tax burden. In a country where government itself takes, transfers and spends over one-third of the national output, taxes are obviously a

major influence on economic decision-making. Your managers continue to be active in seeking permanent tax reductions and constructive tax changes that will produce reinforcing effects both in consumer demand and business investment. Our viewpoints and recommendations are set forth more fully in the review of public issues on pages 28-31 of this Report.

Assuming that Congress enacts tax cuts soon enough to have effect in 1978 and defers the more controversial tax measures, we foresee reasonable growth continuing for the U.S. economy. And continued U.S. recovery should have invigorating effects on many other nations. Given these favorable factors, we expect General Electric to continue meeting its growth objectives.

**General Electric's Centennial** will be marked during 1978. A hundred years ago this coming October 15, our earliest predecessor came into being when the Edison Electric Light Company was formed to support Thomas A. Edison in his development of the incandescent lamp. Edison's company eventually became an important part of General Electric when it was incorporated in 1892.

During 1978, share owners will have opportunities to participate in the modest program planned in celebration of the GE Centennial. As your managers, we regard this anniversary as an occasion not so much to look backward as to remind ourselves of the rich heritage and unique strengths that distinguish this great Company as it sweeps into its second century of serving many of the most worthy aspirations of the societies of the world.



Chairman of the Board  
and Chief Executive Officer  
February 17, 1978

## Consumer products and services

In millions	1977	1976	1975	1974	1973
Revenues	\$4,148	\$3,453	\$3,009	\$3,376	\$3,250
Net earnings	256	204	114	91	151

Results shown above are for General Electric's businesses in major appliances, air conditioning, lighting, housewares, audio products, television receivers, and broadcasting and cablevision services. Organizationally, this Sector includes General Electric Credit Corporation, whose results are excluded from those above. Credit Corporation results are reported on page 8.

Consumer products and services, exclusive of the Credit Corporation, contributed 22% of GE's total revenues for 1977 and 23% of the Company's earnings.

Benefiting from 1977's favorable consumer markets, revenues increased 20%, with earnings up 25%.



The new GE JET 110 countertop microwave oven lets you cook fast — by "Time" or "Temperature" — or slow, with the automatic Simmer 'N Cook® setting. This versatile appliance has a digital solid-state MicroTouch® control panel and four power level settings. It comes with a comprehensive microwave guide and cookbook.

Right: Remote-control tuning that uses infrared light to trigger the TV set's functions is featured on GE's newest television consoles, which also make use of the vertical interval reference (VIR) broadcast signal to adjust color automatically. GE's VIR broadcast controlled color system won an Emmy award for the Company in 1977.

**Major appliances**, which include both GE and Hotpoint® brands of kitchen and laundry equipment, showed strong profitable growth over 1976, based on substantially higher sales volume, and on rigorous cost control and appropriate price actions to recover inflation in material and labor costs. GE's major appliance unit shipments were up more than the industry's average increase of 13%. Results for the year were enhanced by demand stimulated by the new line of six appliance colors called The New Naturals®: almond, fresh avocado, harvest wheat, coffee, onyx and snow.

A major portion of appliance sales is to a variety of retail outlets. These sales increased over 1976, with replacement sales — already more than half the total — representing a growing percentage. Improvement in sales to contractors for installation in new housing units — the other principal market for these products — reflected the 1977 increase in single-family housing starts and completions.

General Electric maintains the largest company-owned appliance service system of any major appliance manufacturer, with a 1977 total of 127 factory service operations for GE and Hotpoint major appliances, room air conditioners and GE television. This service network covers ap-



proximately 70% of the Company's major appliance population and is augmented by thousands of independent servicers trained and franchised by General Electric. Further innovations introduced in appliance service during the year include provision for evening and Saturday service in a growing number of locations to accommodate households in which all adult members work outside the home.

Increased sales abroad of major appliances and air conditioning equipment maintained General Electric's position as one of the largest U.S. exporters of those products.

Looking ahead, the Company presently expects further increases in sales for the major appliance industry in 1978, and a number of factors provide a favorable outlook for continued growth in following years. Through 1981, the industry expects that demographic trends and the aging of appliances now in service should increase demand as new household formations rise and the replacement market strengthens. These factors should favorably affect both retail and contract sales.

**GE air conditioners**, both room and central, benefited from 1977's generally hot summer and from increasing customer interest in high-efficiency units. GE's central air conditioning equipment sales grew at a faster rate than industry sales in 1977; this trend is expected to continue as a result of the strong GE position in heat pumps.

General Electric is the leading manufacturer of heat pumps. Demand for the Weathertron® heat pump for heating and cooling increased more than 50% over 1976 levels. Heat pumps are now being installed in almost 20% of new homes. In late 1977, new higher-efficiency Weathertron units were introduced.

**Lighting products** from General Electric include incandescent, fluorescent, photo, miniature and high intensity discharge lamps, as well as luminaires for street

(continued on page 8)

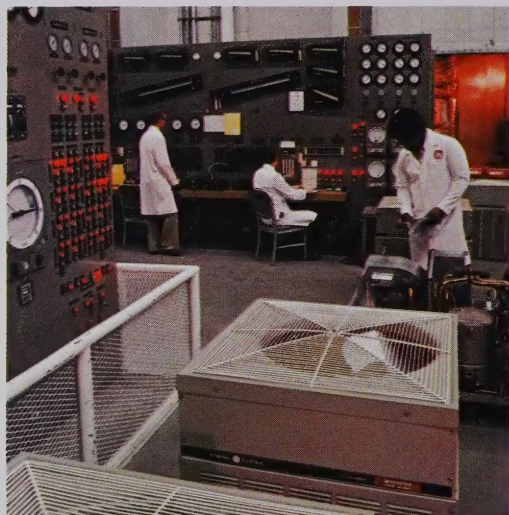
In a year of high consumer spending, growth of General Electric product lines generally outpaced the market.



Showcase for electrical living is provided by GE model kitchen utilizing new GE appliance colors — almond and onyx — and a full complement of major appliances: a no-frost refrigerator-freezer with Custom Ice Dispenser, Hi-Low Microwave Cooking Center, Potscrubber II® built-in dishwasher, food waste disposer, and a built-in trash compactor. Cabinets are covered with General Electric Textolite® decorative laminates.

General Electric Credit Corporation

In millions	1977	1976	1975	1974	1973
Net earnings	\$67	\$57	\$50	\$37	\$41



**Rigorous quality control tests at Tyler, Texas, facility insure reliability of GE's energy-efficient Weathertron® heat pumps for heating and cooling.**

lighting and residential post lights. Sales and earnings of lighting products were strong in 1977.

In 1977, the Watt-Miser® II, a second generation of the successful new fluorescent for commercial and industrial use, joined GE's Bright Stik® plug-in fluorescent for the home in the Company's line of energy-efficient lamps.

Also unveiled in 1977 was the General Electric Lamp Progress Express, a fleet of eight specially-outfitted vans that demonstrate how to use the latest developments in lighting technology to save energy and dollars and still provide lighting levels that can make improvements in productivity, safety and security in offices, factories and stores. The GE vans are "on the road" visiting commercial and industrial lighting customers as well as local, state and national government officials.

**Housewares and audio products** sales and earnings also showed improvement over 1976. Housewares include small appliances for household and personal care use. More than 10 new General Electric housewares products were introduced



**Innovations in GE and Hotpoint appliance service include evening service calls in some areas. Post light at left is a General Electric luminaire.**

in 1977, including the food processor, facial cleaner, security light and Fry Pot® deep fryer.

Industry sales of smoke alarms reached six million units, with GE's Home Sentry® smoke alarm emerging as a leader in this growing market.

**GE's television receiver operations**

showed continued sales improvement and a stronger industry position. Earnings were up somewhat. In 1977, General Electric won an Emmy from the National Academy of Television Arts and Sciences for "the first application of the vertical interval reference (VIR) signal system to television receivers," improving the color reception of GE sets. Also during the year, a new remote-control TV tuning system that uses infrared light to trigger the TV set's functions was introduced.

In December, General Electric and Hitachi Ltd. of Japan announced plans for the formation of a new jointly-owned company, General Television of America, Inc., for the engineering, manufacturing and marketing of General Electric, Hitachi and private-label brand television sets and for

the manufacture of color television picture tubes for other television manufacturers. Under the proposed agreement, the new company will combine GE and Hitachi technologies and will utilize the facilities and personnel of GE's current television business. The combination is expected to make this business more profitable by realizing higher volumes of production. GE and Hitachi each will own 50% of the shares of the new company, establishment of which is contingent upon necessary corporate and governmental approvals.

**Broadcasting and cablevision** operations include 3 AM and 5 FM radio stations, 3 TV stations and 12 cablevision systems. Earnings performance of these operations continued to improve in 1977.

**The outlook** for operations making up the Consumer Products and Services Sector continues to be favorable. Although industry growth is not expected to be as vigorous in 1978 as in 1977, the Company expects a good sales year in 1978 for major appliances, lighting, housewares and audio products. As discussed on page 28, the tax reductions for individuals proposed by the Carter Administration would reinforce individuals' purchasing power and help sustain the present strong consumer markets.

**General Electric Credit Corporation**

earnings in 1977, as shown above, were 18% higher than in 1976 and accounted for 6% of the Company's total earnings.

General Electric Credit Corporation (GECC) is a wholly-owned nonconsolidated finance affiliate, engaged primarily in consumer, commercial and industrial financing. Products of companies other than General Electric constitute the major portion of products financed by GECC.

See notes 1 and 13 for additional information and condensed financial statements.

# Industrial products and components

Components for manufactured products and production equipment for industrial customers, together with transportation systems, led a year of broad-based gains for GE industrial businesses.

In millions	1977	1976	1975	1974	1973
Revenues	\$3,698	\$3,270	\$3,027	\$3,284	\$2,790
Net earnings	191	160	133	148	103

The Industrial Products and Components Sector includes GE operations serving industrial markets for capital equipment such as large motors and controls, component products incorporated by manufacturers and contractors into their own products, transportation systems, apparatus repair services, and distribution supply centers for electrical and allied products.

The Sector accounted for 20% of total General Electric revenues in 1977 and 17% of the year's total net earnings.

All of the main business elements making up this Sector contributed to the year's increases in revenues and earnings, with component products, industrial equipment for contractors and manufacturers, and transportation systems accounting for most of the increases. As a result, the Sector in 1977 showed 13% higher revenues and 19% higher earnings than the comparable totals for 1976.



**Electrified railroading is stirring renewed interest in many countries. Shown: new General Electric locomotive for Taiwan's rail system.**



**Energy-efficient motors from GE, an industry leader in motor technology, provide more power from a lower energy input. An Energy Saver unit similar to the one shown has been installed in the solar heating system in this Denver home to circulate fluids in the solar collector.**

**Component products**, such as appliance and electronic components supplied for use in GE products and those of other manufacturers, comprise solidly profitable businesses for General Electric. Also included in this product spectrum are specialty transformers, industrial heating, and food service equipment.

In 1977, GE's appliance components business maintained its leading role as a supplier of small motors, controls and other components for appliances and air conditioning equipment. Benefiting from the industry's high volume of production during the year, this GE business posted new highs as a generator of earnings for the Company.

To help its customers meet new goals in energy conservation, the GE appliance components business further strengthened its development program. Results include new appliance motors that require from 15% to 35% less energy input than the motors they replaced but give the same performance.

The new General Electric digital timer

developed for electric and gas ranges has become the standard for most U.S. range manufacturers.

GE sales of electronic components are relatively evenly distributed among three major product areas: capacitors, semiconductors and electron devices. GE operations held to their course of achieving steady, profitable growth in the areas which they serve in this volatile market — particularly in high-power semiconductor technology. Gains in sales of electronic components in 1977 reflected the economic recovery, and the 1978 outlook is for continuing improvement.

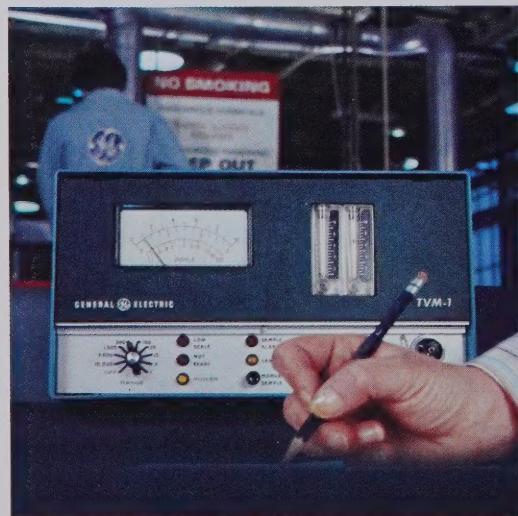
**Industrial equipment** from GE consists of electrical products for construction applications and items such as motors, drives and controls for industrial use. With capital spending for U.S. plant and equipment increasing in 1977, after two years of virtually no growth, sales and orders for these

(continued on page 10)



U.S. energy plans, aiming at almost doubling present coal use, are enlarging the market for big GE d-c motors and generators to power excavators.

Below: GE's new Toxic Vapor Monitor helps industry meet OSHA requirements by monitoring environments for halogenated toxic gases.



General Electric lines began to show improvement.

In recent years, these traditional General Electric businesses have been undergoing a thorough overhaul to upgrade their technology, modernize their production facilities and make their product offerings more cost-competitive. The results were evident in the good increase in earnings realized in 1977.

With increased emphasis on coal as an energy source, orders were strong for General Electric d-c motors, generators and controls to power excavators, shovels and other mining equipment. Similarly, the push to increase hydro generation of electricity kept the Company's facilities for producing large waterwheel generators loaded near capacity. Offshore orders for steel mill drives took up some of the slack in the depressed U.S. market.

Orders for industrial power distribution products, controls and circuit protective devices were strong in 1977, reflecting the Sector's improved technological position and new products supplied to a growing market. Domestically, orders for these lines picked up in both the private and publicly-financed market segments. Offshore, the additional integration of affiliate operations in the United Kingdom, and establishment of a new operation in Saudi Arabia, positioned the Company for greater penetration of the international markets for low-voltage power distribution and control products.

**Transportation equipment** supplied by General Electric had a good year in sales and earnings growth.

The resurgence of the domestic locomotive market set the pace. With U.S. railroads rebuilding their rolling stock and anticipating increased coal shipments, this GE business sharply increased its shipments of diesel-electric road locomotives to domestic customers and built its orders backlog in 1977. Orders were strong for the New Series locomotive introduced

in 1976, improving the Company's position in domestic markets. International sales continued to be a source of strength for the Company's transportation equipment businesses. General Electric shipped the initial units of an order for 74 electric locomotives to Taiwan, with successful on-track tests completed and passenger service, scheduled for 1978.

The Company's profitable business in transit equipment was sustained by the orders backlog and by new contracts for the overhaul and upgrading of transit equipment.

A positive factor in sales of electric wheels for off-highway haulage vehicles was the reemphasis on utilization of coal as an energy source.

**Services businesses** conducted by the Industrial Products and Components Sector continued their expansion:

- Apparatus service shops apply General Electric know-how to the maintenance, inspection, repair and rebuilding of electrical and mechanical apparatus, including equipment produced by other manufacturers as well as General Electric.

**Reemphasis on coal as an energy source is strengthening the markets for GE motorized wheels, here powering a 130-ton coal hauler.**



Increasing U.S. emphasis on coal as an energy source is creating growing markets for General Electric motors, controls and electric wheels used in haulage operations.

The Company has built a worldwide network of these shops, and in 1977 added locations in the United States and other countries, including Canada, France, England, Saudi Arabia, Brazil and the Philippines.

- Distribution services are provided by the General Electric Supply Company, offering contractor, industrial, utility and commercial customers the convenience of supply centers that are well-stocked with GE and other products. This General Electric business's growing emphasis on international markets was evidenced by the opening of an additional new center abroad in 1977.

**The short-term outlook** for the U.S. markets served by this Sector is one of continued economic recovery. GE forecasters expect a 6% increase, in real terms, for 1978 industrial plant and equipment expenditures. Commercial and industrial construction is expected to rise by some 12%, with residential construction holding at the high 1977 level.

**Over the longer term**, the outlook for businesses supplying capital equipment for industry relates directly to the public issue emphasized in this Annual Report: the need for a sustained resurgence in U.S. business investment. Industry recognizes that significant capital expenditures are necessary to strengthen the ability of U.S. businesses to compete against increasingly sophisticated international producers. National interests are at stake: improved productivity from modern plant and equipment is one key way to check inflation; and more competitive U.S. industries will help provide more jobs for a growing work force and a more favorable balance of trade.

Action along lines suggested on page 28 of this Report can break the investment logjam and add the needed vitality of increased U.S. spending to the health and duration of the present U.S. economic recovery.



The expanding network of GE apparatus service shops offers increasingly sophisticated expertise to industrial and commercial customers. There are now more than 60 locations which repair and maintain, rent or lease instrumentation and communication equipment.

# Power systems

In millions	1977	1976	1975	1974	1973
Revenues	\$3,218	\$2,998	\$2,885	\$2,762	\$2,429
Net earnings	75	61	62	94	120

Serving the United States' shift toward an electrified economy, General Electric's Power Systems Sector is the leading supplier of electrical generation and power delivery equipment to the U.S. electric utility industry. In addition, it has leadership positions in important industrial and marine market segments both in the U.S. and abroad. For industrial customers the Sector leads in supplying in-plant power generation facilities and steam turbines for mechanical drive applications. In the marine segment it is the foremost producer of turbines and gears for ship propulsion supplied both to commercial shipping and the U.S. Navy.

Other operations in this Sector include the Company's worldwide business in equipment installation and engineering

services and the Knolls Atomic Power Laboratory, developing nuclear power systems for the U.S. Navy.

Revenues for the Sector in 1977 were up 7% and earnings showed a 23% gain from the relatively low 1976 level.

Orders from electric utilities for equipment other than nuclear power systems began to pick up somewhat in the last half of 1977. However, utility purchasing is still constrained by high reserve margins and by continuing uncertainties regarding U.S. energy policy. The Sector's backlog of unfilled orders, including nuclear equipment, was \$13.2 billion at the end of 1977, compared with \$13.5 billion at the previous year end.

The Sector accounted for 17% of the Company's 1977 revenues and 7% of its total earnings.

**Gas turbine** earnings were up significantly from 1976, principally on the strength of overseas business.

With many countries relying on these turbines for quick increases in generating capacity, some 75% of GE gas turbine sales in 1977 were made to international customers. Significant shipments included those for the Soviet Union for pipeline pumping and to Korea for combined-cycle STAG® (steam and gas turbine) plants. Interest in highly efficient STAG plants, which utilize the exhaust heat from the gas turbines to help power the steam turbines, is increasing, especially in energy-poor countries.

**Steam turbine-generator** earnings were down substantially in 1977 as shipments were rescheduled to reflect changes in the timing of customer delivery requirements.

The backlog for steam turbine-generator equipment was \$4.8 billion at year-end 1977. The comparable backlog for 1976 was \$4.7 billion.

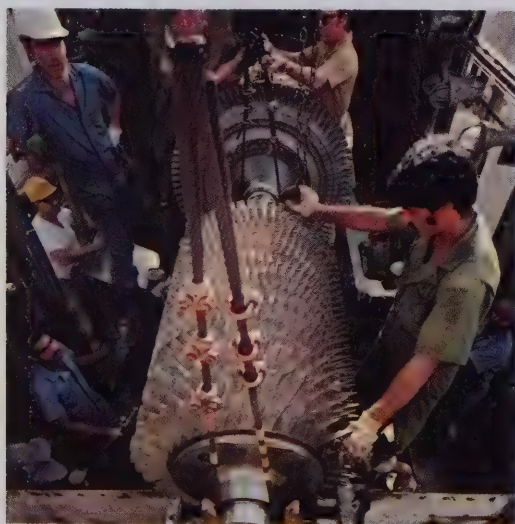
These operations continue their emphasis on high efficiency and reliability to maintain product leadership.

Sales of mechanical drive turbines were an area of strength in 1977. The needs for high horsepower and variable speed drive capable of meeting compressor requirements, coupled with the economics of using process steam, have resulted in the increased application of General Electric mechanical drive steam turbines for driving power.

With world shipping capacity still exceeding demand, the Sector's marine propulsion business was sustained by work on U.S. Navy powerplants.

**Nuclear equipment** supplied by General Electric includes boiling water reactors and fuel assemblies. The Company's nuclear business operated at a loss in 1977. As reported previously to share owners, GE is making substantial expenditures on engineering and development in support of nuclear projects now in the backlog. These expenditures, when coupled with the effects of deferments of shipments and cancellations of nuclear orders, are likely to result in losses for this business over the next several years.

**Better linkage between large electrical systems:** special GE transformer compensates for differences in the systems so that power flow between them can be controlled.



General Electric offers a worldwide service in installation and service engineering. To help customers avoid unplanned shutdowns, GE specialists provide maintenance services, as represented by planned overhaul of GE gas turbines on Persian Gulf offshore oil platform.



Shipments of nuclear equipment in 1977 reduced the year-end backlog to \$5.5 billion, of which \$2.3 billion is scheduled for shipment after 1982. The comparable backlog for 1976 was \$6.0 billion, of which \$2.5 billion was scheduled for shipment after 1981.

While GE management believes that increased reliance on nuclear power is an essential element of an effective U.S. energy policy, the nuclear market remains depressed. For the U.S. utility industry, cancellations of nuclear plants have outnumbered new orders during the last three years. Resumption of nuclear orders will require more than renewed demand for electrical generating equipment. There must be governmental action to reform the nuclear licensing process and to resolve existing uncertainties regarding such issues as radioactive waste storage and nuclear export policy. During 1977, there was increasing recognition of the problems besetting the nuclear industry. However, the required actions remain tied up in the broader controversy over U.S. energy policy as discussed on page 29 of this Report.

**General Electric's power delivery** businesses, producing transformers, power circuit breakers, switchgear and meters, reported increased sales and earnings for the year. Sales of distribution transformers showed the strongest increase, with meters also experiencing a good pickup during 1977. Other power delivery operations are showing more gradual improvement.

**Installation and service engineering** work carried on by General Electric includes on-site engineering support for the Company's products sold to electric utility, industrial and marine customers. Faced several years ago with a slowdown in domestic installation activities, this General Electric service organization vigorously developed its business in systems maintenance for utility and industrial customers. The result in 1977 was a healthy rise in both

sales and earnings for this business.

**The outlook** for the Power Systems Sector was strengthened by three principal developments during 1977:

- Electrical demand in the United States continued to increase, sustaining the upturn from the no-growth years of 1974-75. Total U.S. consumption of electricity rose approximately 5.3% over 1976.
- The financial condition of the U.S. utility industry continued to improve.
- Products and services for such special applications as gas turbines for pipeline pumping and mechanical drives for industrial processes showed a year of good improvement.

For the period to 1990, General Electric planners foresee an average annual kilowatt-hour sales growth for the industry of about 5%. Even though this rate of increase is below historic rates, growth of this magnitude, combined with increasing equipment replacement sales, will provide sustained market growth opportunities for power systems.

**Progress toward resolution** of some longstanding legal issues was made during the past year. On September 16, 1977, the Federal District Court in Philadelphia entered a modification of the terms of a 1962 antitrust decree relating to the sale of large steam turbine-generators, in the same form as agreed upon between General Electric and the U.S. Department of Justice in December 1976. Under the decree modification, the Company accepts certain limitations on its future conduct.

On February 2, 1977, the Company and four subsidiaries of American Electric Power Co. agreed to a settlement of an antitrust litigation against the Company relating to General Electric's price policy on the sale of turbine-generators. That settlement was contingent upon court approval of the modification of the 1962 antitrust decree referred to above. Accordingly, on September 23, 1977, an order of



**For high-growth areas such as Jeddah in Saudi Arabia, GE packaged gas turbines can be installed in a relatively short time.**

dismissal was entered in the Federal District Court in New York in the American Electric Power suit. General Electric had previously granted an extension of the statute of limitations to other utilities with respect to their purchases of steam turbine-generators. Such extension agreements remain in effect until April 1, 1978.

**As reported** in previous Annual Reports, customers have required that nuclear fuel be sold with warranties covering the useful life of the fuel, even though the experience base for predicting the life of nuclear fuel under power plant operating conditions is still relatively small. As of December 31, 1977, there were open warranty commitments on fuel with an original sales value of approximately \$775 million, and on fuel in the backlog presently valued at \$2.7 billion, covering deliveries through the 1980s.

In addition, fulfillment of a small number of its nuclear fuel orders requires the Company to procure uranium concentrate. General Electric has on hand or under contract sufficient uranium to meet presently anticipated requirements. Also, some fuel orders include reprocessing, plutonium fabrication and waste disposal services. In view of current U.S. Government policies, it is highly uncertain whether such services can be provided.

# Technical systems and materials

In millions	1977	1976	1975	1974	1973
Revenues	\$4,145	\$3,688	\$3,251	\$3,191	\$2,579
Net earnings	248	202	160	179	115

In General Electric's 1977 organizational realignment, the Technical Systems and Materials Sector was given responsibility for a wide range of the Company's high-technology and materials businesses, including aircraft engines, diverse types of aerospace products, a variety of man-made materials, medical systems, mobile radio, data communication products, and information services.

The businesses constituting this Sector reported an increase in revenues of 12%, with a sharp improvement of 23% in the rate of earnings. The strongest gains were posted by engineered materials.

The Technical Systems and Materials Sector accounted for 22% of total General Electric revenues in 1977 and 23% of the year's total earnings.

**Engineered materials** comprised a high-growth area for General Electric in 1977. These span a wide spectrum of high-performance plastics, silicones, tungsten-carbide metals, Man-Made® diamonds, and Borazon® abrasives used by industrial customers.

Leverage for profitable growth in many of these materials is provided by current major trends. The drive to conserve energy, for example, enhances the role of GE's engineering plastics as substitutes for metal, since these plastics require less energy to produce. In addition, their weight advantages facilitate the design for lighter, energy-saving vehicles. Similarly, concerns for safety are broadening the market for tough General Electric Lexan® plastic sheet glazing materials which are far stronger than glass.

Earnings of these materials operations were improved by earlier vertical integration projects. In 1977, construction began at Mt. Vernon, Ind., of a \$90 million General Electric plant to produce phenol, a major raw material in the production of engineering plastics.

The market for GE silicone rubber, lubricants and related materials has



changed from a specialty market to a broad consumer-influenced market where these high-performance materials are used in such applications as caulking and weather-stripping sealants. In 1977, this General Electric business completed an expansion doubling its production capacity in the U.S. and expanded its international operations.

The Company continued to build an international business in ultra-hard cemented tungsten-carbide metals used as cutting tools in a wide range of industrial applications. The business of supplying Man-Made diamonds sustained its growth in 1977, aided by the development of larger diamonds for metal-bonded saw applications.

**Today's revolution in materials is typified by the Walt Disney School in Chicago, Ill., whose windows of GE Lexan plastic sheet provide improved security and insulation.**

Comprising a spectrum of high-technology businesses, this Sector drew strength in 1977 from growth in engineered materials, commercial aircraft engines, medical systems, mobile radio and information services.

**GE aircraft engine** businesses, serving aircraft, marine and industrial markets, increased sales and earnings in 1977.

Commercial aircraft engines by General Electric continued to build a solid reputation among the world's leading airlines. During the year, independent reports of comparative engine performance showed GE powerplants achieving an outstanding record of reliable and economical service. This record was a factor in the continued demand for General Electric commercial engines. At the end of 1977, 53 customers worldwide had selected GE CF6 engines to power 350 aircraft. And 68% of all the wide-bodied aircraft selected by airlines worldwide during 1977 will be powered by GE CF6 engines.

In preparation for the next major commercial market — short- and medium-range aircraft — the Company continued its co-development, with SNECMA of France, of the CFM56 "10-ton" engine. Agreement was reached to flight test the CFM56 on a Boeing 707 aircraft in 1979. The CFM56 consumes up to 25% less fuel than other engines in its class. GE also announced a 32,000-lb. class engine for larger aircraft serving this market.

Strong demand for marine and industrial applications of aircraft-derived en-

**For the National Aeronautics and Space Administration's Space Shuttle, General Electric has built and is operating support facilities and is developing special systems and experimental packages.**



gines continued in 1977, with GE LM2500 powerplants specified by 11 navies of the free world, for oil and gas pipelines, and industrial processing plants. Tests were conducted during the year on a new engine, the LM5000, which provides twice the horsepower and is 10% more efficient.

Effects of cancellation of the B-1 bomber production program were partially offset by the success of other commercial and military engine programs. Development work on the F101 engine for the B-1 is continuing, and other applications are under study.

The Company's T700 engine, already selected for the Army's next-generation helicopter, the Black Hawk, was also chosen to power Navy LAMPS (Light Airborne Multi-Purpose System) helicopters used in sophisticated submarine detection and attack applications. And the U.S. Air Force selected GE CF6 engines to power its Advanced Tanker Cargo Aircraft. Continued development of the F404 engine for the F-18 fighter aircraft will include a maiden test flight in 1978.

**Airbus Industrie A300, powered by two General Electric CF6 engines, meets the airlines' need for a medium-size, fuel-efficient aircraft. Ordered by a number of airlines for international service, the plane also entered U.S. service in 1977.**

**Aerospace** sales and earnings were slightly above 1976 levels. This high-technology business is a leading contributor to U.S. strategic defense and a leader in civilian application of space technology. Several events of 1977 should favorably affect these businesses:

- GE was chosen to design and build satellites for an advanced Defense Satellite Communications System that will provide worldwide communications for the nation's defense forces and other government agencies. Also, Japan's National Space Development Agency selected General Electric and Toshiba to design the first in a series of experimental satellites for earth resources and meteorological missions.

- The first sale of a new generation of advanced, solid-state surveillance radar systems — the GE 592 — was recorded

(continued on page 16)

in 1977, and final pre-production tests were conducted on a new mobile solid-state system, the AN/TPS-59.

- Solar energy research during the year included contracts for developing photovoltaic systems to convert sunlight directly into electricity, and for an experimental new type of parabolic dish solar collector for a system to provide electricity, steam and hot water for a new factory in Georgia.
- General Electric was selected to develop the variable-speed, constant-frequency (VSCF) electrical generating system and digital flight control system for the U.S. Navy's new F-18 Hornet aircraft.
- Delivery was made in 1977 of the deceleration modules for the Pioneer Venus spacecraft to be launched in mid-1978.

**Medical systems** supplied by GE include conventional x-ray systems, for which the Company has long been the leading U.S. supplier, and several types of specialized diagnostic imaging and critical-care monitoring equipment. This business showed good gains in both sales and earnings in 1977.

**Developments such as this new high-speed TermiNet® 1232 teleprinter keep General Electric strongly positioned in data communication technology.**



Important among new systems is computed tomography, or CT, which produces cross-sectional images of the head and body. Successful introduction of an ultra-high resolution scanner and the start-up of the new Milwaukee production facilities strengthened GE's position.

General Electric also introduced the first totally mobile nuclear imaging camera/computer combination, and patient-monitoring products were updated with "state of the art" technology.

The year also showed renewed growth in orders for GE x-ray core products. The substantial business in follow-on supplies and services, built on the industry's largest domestic service organization, sustained its growth.

**Mobile radio and computer interface** equipment are two facets of the communications equipment industry in which General Electric is building growth businesses on an international scale.

Specialized facilities in Lynchburg, Va., were expanded in 1977 to increase the electronic sophistication of GE mobile radio equipment. Also, GE's European manufacturing affiliate, Storno, is competing successfully in international markets, and is pooling its technology with that of GE to upgrade product offerings.

Another year of growth in sales and earnings was also realized in General Electric communications equipment — the terminals, printers and related devices that enable computer users to communicate with remote central processors.

**GE's information services** business continued to grow sales and earnings as over 5,000 customers around the world make use of its extensive line of computing services. These business-oriented data processing capabilities are backed by a wealth of resources including the global Mark III® network. A new layer of growth has been added by the marketing of complete business system services, such as



**GE's MPX® programmable x-ray generator line provides automatic selection of examination techniques, and powers several examination rooms to hold down costs.**

financial consolidation, cash management and order service.

**The outlook:** Each of the major businesses making up this technology-oriented Sector has underway the advanced developments to sustain future growth, including new families of plastics with properties superior to those in use today, more efficient aircraft engines, advanced space systems and civilian applications, and further innovations in health care, communications products and information services.

At the same time, as discussed on page 30, GE managers are calling for new programs that will reinvigorate U.S. technology and help regain the competitive edge in international trade that flows from technological leadership.

In millions	1977	1976	1975	1974	1973
Revenues	\$ 965	\$1,003	\$ 683	\$ 526	\$ 389
Net earnings	196	181	108	97	76

GE's wholly-owned natural resources affiliate, Utah International, conducts an international business principally in the mining of coking coal, steam coal, uranium, iron ore and copper. Other operations conducted by Utah International include oil and gas production, ocean shipping primarily in support of its mining activities and, on a smaller scale, land development.

Utah International increased its earnings by 8% from the 1976 level to achieve a thirteenth consecutive year of record earnings. This earnings record is particularly noteworthy since it was attained in a year of general weakness in the steel markets served by its coking coal operations, and in the face of severely depressed copper prices. Major positive factors were improved dividend income from 1977 operations of Utah's nonconsolidated uranium mining affiliate and higher steam coal activity.

Revenues for 1977 were 4% below 1976, primarily because product sales of Utah International's wholly-owned Lucky Mc Uranium Corporation are no longer consolidated after Utah's merger with GE on December 20, 1976.

Utah International contributed 5% of General Electric's total revenues and 18% of GE earnings for 1977.

Over 96% of Utah's mineral sales backlog of \$5.3 billion, including uranium, at the end of 1977 is covered by contracts containing escalation clauses that offer substantial protection against future cost increases. Virtually all sales contracts are payable in U.S. dollars.

Approximately 83% of Utah's 1977 revenues and 71% of net earnings originated from outside the United States.

**Australian coking coal** operations continued to be Utah's major source of earnings in 1977. Coking coal results for the year were second only to the 1976 total, despite the weak markets encountered.

Sales made to "spot" purchasers during 1977 largely offset the reduced



deliveries to the Japanese steel mills which are Utah's principal coking coal customers. However, reflecting the weak coking coal market, price realizations for "spot" sales generally were lower than those obtained under the company's long-term sales agreements which account for the great majority of sales. Shipments from the Utah-operated Blackwater, Goonyella, Peak Downs and Saraji mines totaled 16.1 million metric tons in 1977, compared with 16.5 million metric tons in 1976.

During 1977, Utah made commitments to expand its already significant position as a coking coal supplier. By selling additional joint-venture interests to Australian entities, Utah was able to meet Australian Government guidelines for the development of the country's natural resources and to obtain approval for the development of a new mine at Norwich Park. This mine, which will be Utah's fifth coking coal mine in Queensland, Australia, is scheduled to begin shipments in late 1979, and will add about 4.3 million metric tons to the total annual production capacity of Utah's mines.

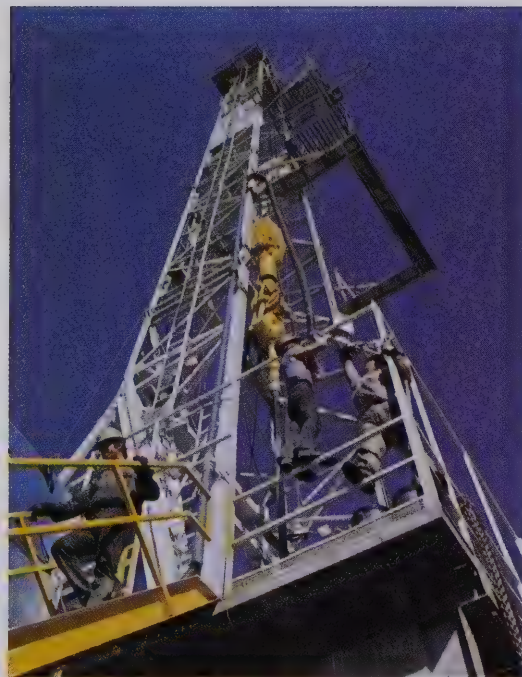
**Applying surface mining techniques that allow the use of large-scale, cost-saving equipment helps place Utah's coking coal operations in Australia among the world's low-cost producers.**

Utah now owns 89% of Blackwater and 68% of the other four Australian mines.

Although the estimated \$250 million capital cost for Norwich Park is substantially higher than that for development of the earlier mines, Norwich Park will benefit from many of the characteristics that place Utah's coking coal operations among the world's low-cost producers.

All mines have relatively easy access to thick coal seams through surface mining techniques which allow the use of very large-scale, cost-saving equipment, much of which is operated around the clock under excellent climatic conditions. To realize the full potential of the area, the company is initiating both deep strip-ping and underground mining methods. Further enhancing Utah's competitive position, Utah's modern deep water port, which is designed to load simultaneously two ships of the 100,000-deadweight-ton

(continued on page 18)



Growing oil and gas producer in the GE family, Ladd Petroleum in 1977 delivered some 2.3 million barrels of crude oil and 25 billion cubic feet of natural gas to help meet U.S. energy needs.

Below: Utah International seeks to balance world-wide energy and raw materials needs with environmental concerns. Utah's environmental activities are typified by monitoring procedures established for the marine environment adjacent to the Island Copper mine in British Columbia.



class, is only a relatively short rail-haul from the mines.

**Uranium operations** are conducted by Lucky Mc Uranium Corporation, a wholly-owned subsidiary, all of whose common stock is held by independent trustees. Lucky Mc's record contribution in 1977 resulted from increased uranium shipments and higher per-pound price realizations. The 1977 average price of uranium oxide concentrates benefited from "spot" sales which were made at prices substantially higher than those realized for deliveries made under contracts negotiated prior to the market price increases of recent years. The uranium company's mines and supporting facilities are located in Wyoming. See note 13 to financial statements for additional information.

**Domestic steam coal operations** also contributed to the 1977 earnings gain. Utah's most substantial interest in steam coal is represented by leased operations located on the Navajo Indian reservation in the Four Corners area of New Mexico. In addition, eight miles north of the Navajo mine, Utah operates the San Juan mine as a contractor for another coal company.

**Oil and natural gas operations** conducted by wholly-owned Ladd Petroleum Corporation increased sales and earnings. Price levels were higher during the year and a successful exploration and development drilling program continued. The 1977 drilling performance follows a very high percentage of successes in 1976. These ventures have made important additions to Ladd's reserves.

**Copper operations** at the Island Copper mine in British Columbia, Canada, unable to overcome depressed prices, operated at a loss during 1977. In September, all copper production activities at the 25%-owned Cyprus Pima mine located near Tucson, Arizona, were suspended, with

reopening of the mine dependent on improved market conditions.

**In other activities**, Utah's domestic iron ore operations at Cedar City, Utah, increased their profitability in 1977, and operations conducted by Marcona Corporation (presently 46%-owned by Utah) realized improved profits as a result of purchase and resale arrangements for Peruvian iron ore pellets. However, the Mount Goldsworthy iron ore mine in Australia, one-third owned by Utah, operated at a loss because of reduced shipments and its inability to obtain ore price relief. Utah's land development operations, conducted primarily in California, enjoyed higher earnings.

**This was a year of expansion for Utah.**

In Brazil, the SAMARCO iron ore project, in which Utah owns 49% of the voting stock, made its initial shipments late in the year, although efforts to market SAMARCO's products currently are hampered by the reduced requirements of its customers. This \$600 million project will have the capacity to produce 5 million tons of iron ore pellets and 2 million tons of pellet feed annually. Near Craig, Colorado, the Trapper mine, which has the capacity to produce approximately 2.1 million tons of steam coal per year, started mining in May. In addition to the major coking coal mine at Norwich Park, Utah International started development of the Harrow Creek trial underground coking coal mine in Australia. Also, Lucky Mc began to develop the Big Eagle uranium mine in Wyoming.

Over the longer term, Utah International's outlook is bright, based on its position as a low-cost supplier of natural resources basic to the growth of the world's economies. The affiliate maintains an active minerals and petroleum exploration program and, supported by its financial and operating strengths, seeks further investment opportunities in the minerals extraction industry.

The International Sector furthered General Electric's development as an international business in 1977. Latin American affiliates led foreign multi-industry operations.

## Foreign multi-industry operations

In millions	1977	1976	1975	1974	1973
Revenues	\$2,562	\$2,334	\$2,198	\$1,860	\$1,413
Net earnings	71	75	58	59	58

The International Sector has a many-faceted role in the conduct of General Electric's international business, including: a business management role for the foreign multi-industry operations assigned to it; responsibility for U.S. export sales of many GE products and for development of export markets; and a leadership role in the further development and implementation of the Company's total international strategy.

Results shown above are for the foreign multi-industry operations which are the direct responsibility of the International Sector. A five-year summary of United States export sales to external customers is included on page 20.

GE's foreign multi-industry operations consist principally of affiliates in such countries as Canada, Italy, Brazil, Venezuela, Spain, Mexico and Australia, manufacturing varied lines of products oriented toward their host-country markets.

Revenues for these operations increased 10% in 1977. Earnings were down by 5%, as the result of several factors:

- There was not, in 1977, any gain comparable to the nonrecurring pre-tax

**Venezuela's booming economy opens a growing market for varied consumer goods produced by GE's Venezuelan affiliate.**



gain of \$20.7 million realized in 1976 from the sale of the Company's investment in AEG-Telefunken.

- Results from Canadian General Electric Co. Ltd. in 1977 were affected adversely by the recession in the Canadian economy and the weakening of the Canadian dollar. Earnings were also reduced by start-up costs of the new company, Canadian Appliance Manufacturing Company Limited, established during the year to merge the appliance operations of Canadian General Electric and GSW Ltd., and to acquire certain appliance assets of Westinghouse Canada Ltd.

- Depressed economic conditions affected the consumer goods operations of affiliates in a number of other areas.

The contribution to total Company revenues by these affiliates in 1977 amounted to 14%, while they accounted for 6% of total GE earnings.

**Latin American affiliates** continued to show the strongest performance, led by the area's three largest GE businesses — in

**Ten hydro power units built by Canadian General Electric will be at work when enlargement of Venezuela's Guri Dam is completed.**

Venezuela, Brazil and Mexico.

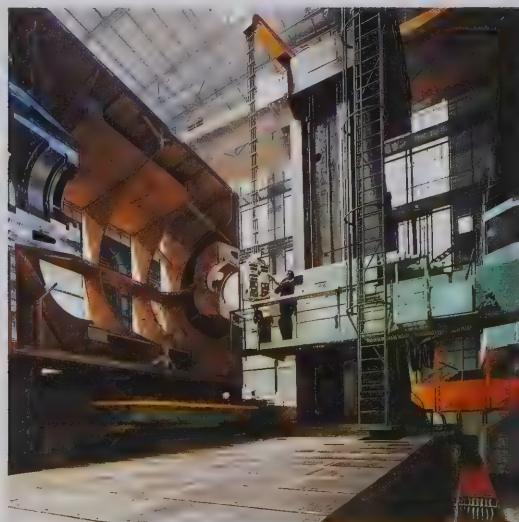
General Electric's Venezuelan affiliate, producing a wide variety of consumer goods for the nation's surging economy, set the pace in 1977. The affiliate also aided Venezuelan customers and the Company's operations in the United States and Canada in reaching agreements on imports of power generation and industrial apparatus needed in Venezuela's growth.

The Company's Brazilian affiliate also had a good year despite the slowing of Brazil's economy. With the country pressing to build exports as an offset to the rising costs of oil imports, GE-Brazil contributed by production of locomotives in its expanded Campinas heavy apparatus facilities for export to Bolivia.

The Mexican affiliate overcame the lingering effects of the 1976 peso devaluation to improve its earnings, although sales showed a decline.

(continued on page 20)

In millions	1977	1976	1975	1974	1973
U.S. export sales	\$2,101	\$1,915	\$1,638	\$1,475	\$ 980



**For Spain's economy, General Eléctrica Española S.A. has built the capability to manufacture large power generation apparatus.**

**Canadian General Electric Co. Ltd.** produces a wide range of consumer, industrial and power generation products for Canadian and export markets.

Launching of the Canadian Appliance Manufacturing Co. Ltd. during the year represents a strong new effort to improve Canada's position in consumer goods production. By combining the manufacturing and distribution facilities of three former producers, the new company aims at achieving economies of scale that will allow it to hold its own competitively in appliance markets. Canadian GE holds 50% of the voting stock and 60% equity in the new company.

**Affiliates in Europe,** the Middle East and Africa were led by the improved performance of Italian-based construction operations and the Spanish company, General Eléctrica Española S.A., whose product range extends from consumer goods to heavy power apparatus. Uncertain economic conditions hampered the operations of GE's Italian manufacturing affiliate.

General Electric's diversified affiliates in Far Eastern countries, including Aus-

tralia, experienced generally lower sales and earnings as the result of weaknesses in their national economies.

**Other principal elements** of General Electric's international activities include exports from the U.S., natural resources activities of Utah International, and operations of nondiversified foreign affiliates. Results from these operations are included in their appropriate Sectors.

In total, General Electric's U.S. export sales to external customers in 1977 rose to \$2.1 billion, compared with \$1.9 billion in 1976. Although five Sectors participated in export operations, the most significant increases were made in gas turbines and aircraft engines.

The Company's exports to Europe/Africa/Middle East areas accounted for \$1,216.9 million in export sales in 1977, compared with \$1,179.7 million in 1976. Sales to customers in the Far East and Australia rose to \$574.2 million in 1977 from the prior-year level of \$371.9 million. Exports to other areas were about the same in both years. Orders for exports in the latter months of 1977 began to show a recovery from the slowdown resulting from the worldwide recessionary period.

To aid in building U.S. exports, the Sector has developed an international projects operation to supervise planning and construction of entire integrated systems, such as complete power plants, where customers prefer this service to the purchase of single pieces of equipment.

The nondiversified affiliates support their appropriate Sectors by concentrating on single product lines, such as lamps or electronic components, either for sale in host-country markets or for incorporation in U.S.-manufactured products.

**The total international business** of the Company, including U.S. exports, nondiversified affiliates and foreign multi-industry operations, together with offshore business conducted by Utah, added up to

about one-third of GE revenues in 1977. Further financial details of the Company's worldwide operations, including information by geographical segments, are shown on page 45.

Overall, General Electric in 1977 maintained its role as a major positive contributor to the U.S. balance of trade.

**Looking ahead,** General Electric's planners continue to regard international markets as areas of good potential for further GE expansion. While slower growth is foreseen overall for the world's economies, the international market for the kinds of products manufactured by General Electric continues in a number of nations to grow faster than the U.S. market. Many countries, especially the developing countries, are in various stages of building and modernizing their infrastructures — including electric power production and distribution, transportation, communications and health services — and these needs represent a good match for GE technologies.

As discussed on page 29 of this Report, General Electric managers believe that world trade is becoming increasingly important to the U.S. economy, not only in terms of the trade balance benefits that accrue from exports but also in terms of creating jobs in the United States.

**Brazil, seeking to build its exports, got a lift from an order won by General Electric's Brazilian affiliate to supply locomotives to Bolivia.**



# Research and development

1977 expenditures on R&D by General Electric set a record, exceeding \$1 billion. "Centers of Research" program helps to make the most of each research dollar.

General Electric's total expenditures on research and development exceeded \$1 billion in 1977, and the Company strengthened its programs aimed at maximizing the return from its research outlays.

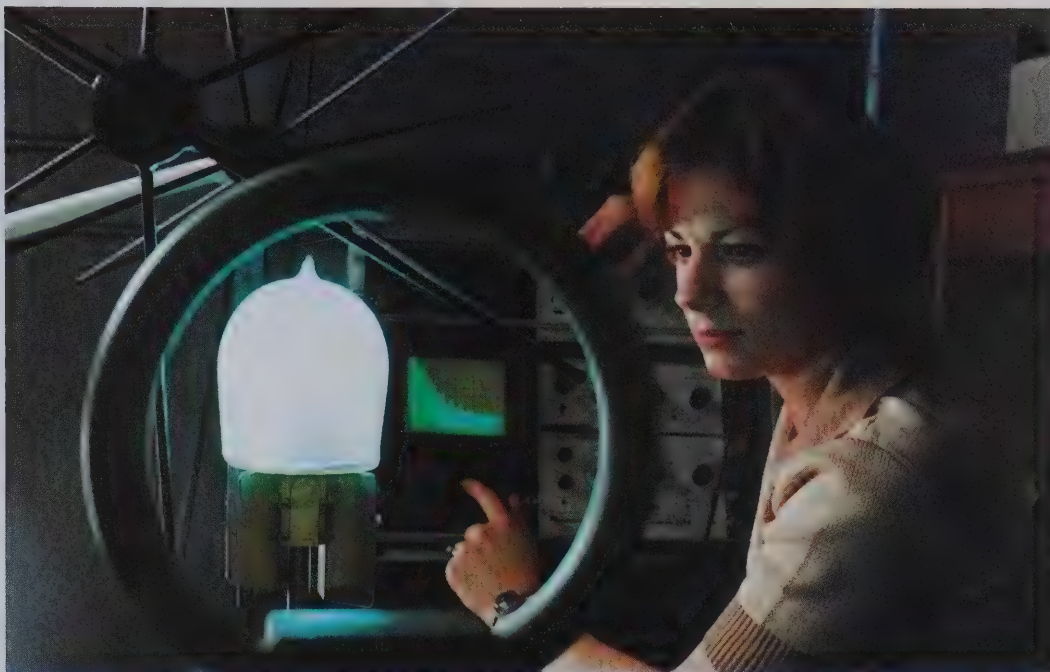
Of the total expenditures of \$1,156 million, the Company-funded portion amounted to \$464 million, while the remaining \$692 million was performed under contract, primarily for U.S. Government agencies. Both GE and contract expenditures were up from 1976 levels.

General Electric further increased the funding for its corporate Research and Development Center, which serves the Company as a whole by conducting the longer-range research that is GE's "insurance policy for the future." The work of this Schenectady, N.Y., Center, together with over 100 laboratory activities associated with product operations, covers the spectrum of scientific and engineering disciplines important to GE businesses.

To make the most of the work done by this complex of laboratories, the corporate R&D Center conducts a program to identify and designate "Centers of Research" throughout the Company, whose special skills and facilities are highly useful both to their own operations and to other parts of GE.

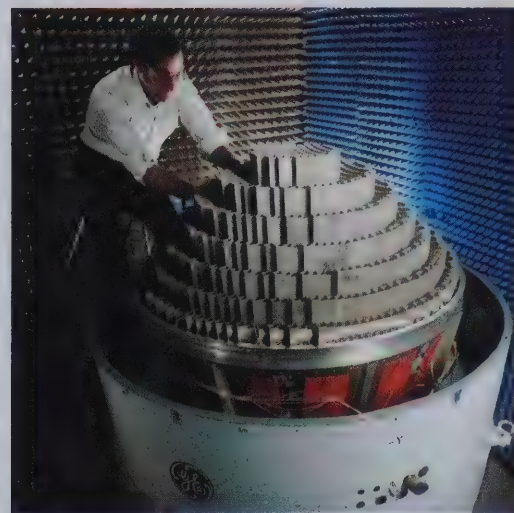
The Company looks to its laboratories as sources not only of product innovations but also of improvements in other business facets. Technologies for increasing industrial productivity, as an example, are under development at the R&D Center, including work on automated inspection systems and computerized graphics as an aid to product designers.

A 1977 highlight of the Center's work: computed tomography images showing, for the first time, human heart muscle damage. Another project representative of the Center's development activities is its work on sodium-sulfur batteries that may make it possible for electric utilities to realize large-scale bulk storage of electricity during low-demand cycles.



GE "Centers of Research" projects include investigations of luminous plasmas as part of the search for more efficient light sources by engineers and scientists in Cleveland, Ohio.

**Below:** Experimental superconducting a-c electric generator, its spinning rotor chilled to  $-452^{\circ}\text{F}$ , is being developed at the R&D Center. Such compact but powerful supercooled machines may help meet tomorrow's energy needs.



New multiple-beam-lens antenna for defense communications satellite is prepared for tests in this anechoic chamber at the GE Space Division facility, Valley Forge, Pa.

# Board of Directors

**Six Committees of the Board**, as listed on the opposite page, help the GE Board keep pace with the growing scope and complexity of its responsibilities by concentrating on specific areas of interest prior to the full Board's deliberations.

In 1977, the Operations Committee heard in-depth reports on the Company's nuclear business and on international issues. Together with the Technology and Science Committee, it reviewed the Aircraft Engine Group's business. The Technology and Science Committee also conducted a special review of aerospace technologies related to energy.

The Finance Committee continued to conduct detailed reviews of such key financial areas as borrowings, investments, and foreign credit and currency exposure. It gave special attention to the Company's foreign investments.

The Audit Committee, made up entirely of Directors from outside the Company, met with representatives of the independent public accountants as well as the Company's own corporate audit staff to review their examinations of the Company's accounts and records and internal controls. Together with the Finance Committee, this Committee also reviewed the GE Annual Report and Proxy Statement.

The Public Issues Committee concentrated on General Electric's product safety management and on the Company's responses to a number of public issues impacting on business.

And the Management Development and Compensation Committee, which does not include any General Electric employees, continued to supply an independent source of judgment on the quality of the Company's management, executive performance and manpower development programs.

**Two new Directors** were elected to the General Electric Board of Directors in 1977, increasing the Board's membership to 20. In June, George M. Low, President of

Rensselaer Polytechnic Institute in Troy, N.Y., became a member; and in December, the Board elected Richard T. Baker, former Managing Partner and now Consultant to Ernst & Ernst, public accountants, in Cleveland, Ohio.

In May, the Board gave approval for an increase in the regular quarterly dividend, from 45 to 55 cents per share of common stock.

Special activities in the Board's busy year included review of the Company's new management system, which was announced in December.

**Operational reviews** gave the Directors firsthand knowledge of GE businesses and the managers in charge of them.

In April, the Board traveled to King of Prussia, Pa., for a tour of the Company's Space Division facilities.

In October, the Board was in Cincinnati, Ohio, for the purpose both of attending the 1977 share owners' Information Meeting and of participating in a technological review of GE aircraft engine operations.

During the year, the Board followed the progress of the General Electric Dividend Reinvestment Plan, launched with the July 1977 dividend at the request of many share owners. Levels of participation in the Plan met with the Company's expectations: by year end, approximately 40,000 share owners, about 7% of the share owners of record, were participating, and over \$3.2 million of GE dividends and optional cash payments had been invested.

**The listing of Directors** at right is in the order of their seniority on the General Electric Board, with the year in which they were first elected to the Board shown in parentheses. Only four of the Directors are members of General Electric management. The other 16 are from outside the Company, having earned positions of leadership in business, finance, education, law and public service.

**Frederick L. Hovde**, President Emeritus, Purdue University, Lafayette, Ind. (1956)

**John E. Lawrence**, President, James Lawrence & Co., Inc., cotton merchants, Boston, Mass. (1957)

**Walter B. Wriston**, Chairman and Director, Citicorp and Citibank, N.A., banking and financial services, New York, N.Y. (1962)

**Ralph Lazarus**, Chairman of the Board and Director, Federated Department Stores, Inc., Cincinnati, Ohio. (1962)

**Gilbert H. Scribner, Jr.**, President and Director, Scribner & Co., real estate and insurance, Chicago, Ill. (1962)

**Edmund W. Littlefield**, Chairman of the Board and Director, Utah International Inc., San Francisco, Calif. (1964)

**J. Paul Austin**, Chairman of the Board and Director, The Coca-Cola Company, Atlanta, Ga. (1964)

**Jack S. Parker**, Vice Chairman of the Board and Executive Officer, General Electric Company, Fairfield, Conn. (1968)

**Reginald H. Jones**, Chairman of the Board and Chief Executive Officer, General Electric Company, Fairfield, Conn. (1971)

**Walter D. Dance**, Vice Chairman of the Board and Executive Officer, General Electric Company, Fairfield, Conn. (1971)

**James G. Boswell II**, President, J. G. Boswell Company, farming and related businesses, Los Angeles, Calif. (1971)

**Charles D. Dickey, Jr.**, Chairman, President and Director, Scott Paper Company, Philadelphia, Pa. (1972)

**Henry L. Hillman**, President and Director, The Hillman Company, diversified operations and investments, Pittsburgh, Pa. (1972)

**Henry H. Henley, Jr.**, President and Director, Cluett, Peabody & Co., Inc., manufacturing and retailing of apparel, New York, N.Y. (1972)

**Silas S. Cathcart**, Chairman and Director, Illinois Tool Works Inc., diversified products, Chicago, Ill. (1972)

**Samuel R. Pierce, Jr.**, Partner, Battle, Fowler, Lidstone, Jaffin, Pierce and Kheel, law firm, New York, N.Y. (1974)

**Gertrude G. Michelson**, Senior Vice President, Macy's-New York, N.Y. (1976)

**Lewis T. Preston**, President and Director, J. P. Morgan & Co. Incorporated and Morgan Guaranty Trust Company of New York, N.Y. (1976)

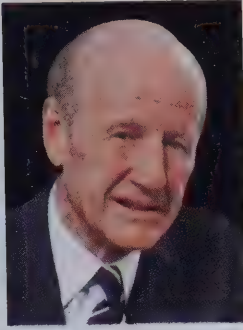
**George M. Low**, President, Rensselaer Polytechnic Institute, Troy, N.Y. (1977)

**Richard T. Baker**, Consultant to Ernst & Ernst, public accountants, Cleveland, Ohio. (1977)

Board Committees concentrated on key areas of Directors' responsibilities. Election of two new Directors, a dividend increase, review of new management system, tours of aircraft engine and space operations highlighted the Board's 1977 activities.



Frederick L. Hovde



John E. Lawrence



Walter B. Wriston



Ralph Lazarus



Gilbert H. Scribner, Jr.



Edmund W. Littlefield



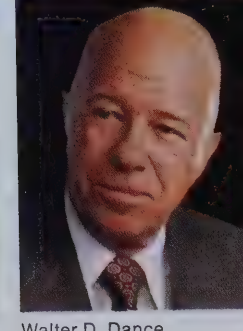
J. Paul Austin



Jack S. Parker



Reginald H. Jones



Walter D. Dance



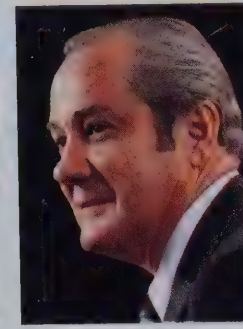
James G. Boswell II



Charles D. Dickey, Jr.



Henry L. Hillman



Henry H. Henley, Jr.



Silas S. Cathcart



Samuel R. Pierce, Jr.



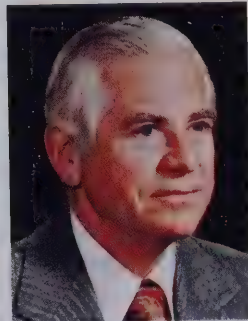
Gertrude G. Michelson



Lewis T. Preston



George M. Low



Richard T. Baker

#### Committees of the Board

##### Audit

C. D. Dickey, Jr., *Chairman*,  
R. T. Baker, F. L. Hovde,  
J. E. Lawrence, G. M. Low,  
S. R. Pierce, Jr.

##### Finance

E. W. Littlefield, *Chairman*,  
R. H. Jones, *Vice Chairman*,  
C. D. Dickey, Jr., H. H. Henley, Jr.,  
L. T. Preston, G. H. Scribner, Jr.,  
W. B. Wriston

##### Management Development and Compensation

R. Lazarus, *Chairman*,  
J. P. Austin, S. S. Cathcart,  
J. E. Lawrence, W. B. Wriston

##### Operations

J. P. Austin, *Chairman*,  
J. S. Parker, *Vice Chairman*,  
J. G. Boswell II, G. G. Michelson,  
L. T. Preston, G. H. Scribner, Jr.

##### Public Issues

H. H. Henley, Jr., *Chairman*,  
W. D. Dance, *Vice Chairman*,  
R. T. Baker, H. L. Hillman,  
R. Lazarus, G. G. Michelson,  
S. R. Pierce, Jr.

##### Technology and Science

J. G. Boswell II, *Chairman*,  
W. D. Dance, *Vice Chairman*,  
J. S. Parker, *Vice Chairman*,  
S. S. Cathcart, H. L. Hillman,  
F. L. Hovde, E. W. Littlefield,  
G. M. Low

# General Electric people

**Higher employment permits broadening of upward mobility opportunities for all employees. Educational aid, occupational safety programs are sustained.**



**GE's Advanced Engineering Course today includes varied faces, with engineering talent as the common denominator.**

**Below: Ten percent increase in General Electric pensions for those who retired on or before January 1, 1975, was good 1977 news for pensioners Henry and Agnes Bollam of Cleveland.**



Reflecting the continued strengthening of the U.S. economy, GE's U.S. employment, including Utah International's domestic employees, at the end of 1977 was 279,000, up 4% from the beginning of the year.

The rise in employment enabled the Company to make significant increases in the numbers of women and minorities in the jobs of managers, professionals and other skill categories such as operators and service workers.

Analysis of domestic GE and GE Credit Corporation employment for the year ended September 30, 1977, shows that the number of women managers increased 18.7%, from 838 to 995, and women professionals increased by 17.9%, from 2,896 to 3,413. Minority managers increased by 12.6%, from 958 to 1,079, while minority professionals rose by 11.8%, from 2,324 to 2,598.

Women and minorities in the lesser-skilled categories also increased. Women represent 44.3% of these lesser-skill jobs and minorities 18.4%. Overall, women account for 28.2% of total GE employment and minorities 11.3%.

**GE's open promotion system** was extended in early 1977, enhancing opportunities for upward mobility of all employees. This program provides a means for advising employees of job openings above entry level and for employees to nominate themselves for jobs for which they feel qualified. Through the third quarter, over 30,000 employees received promotions through the system, more than 15% of whom were minorities and over 35% women.

Also in place at each Company location in 1977 were affirmative action programs for the employment of handicapped persons and Vietnam-era veterans. In mid-1977, GE took a lead role in supporting the special nationwide HIRE program to reduce unemployment among minority and disabled veterans. GE is well on its way to meeting its target of hiring 500 of these special-category veterans.

GE continued to take a leading role in national programs to increase the numbers of women and minority engineering graduates. New communication programs were launched to stimulate interest in engineering careers, and cooperative programs, in which students combine on-the-job training with college courses, were also increased. GE nearly doubled its number of summer job openings, with minorities and women strongly represented.

**Wages and benefits** for GE employees were improved in 1977, including general and cost-of-living increases for most hourly and graded salaried workers. Pay plans for all employees continue to meet the objectives of attracting and keeping competent employees, helping protect wages and salaries against inflation, and rewarding employees for performance. Copies of the General Electric Pension Plan, the Summary Annual Report for GE employee benefit plans subject to the Employee Retirement Income Security Act of 1974, and other GE employee benefit plan documents and information are available by writing to: Investor Relations, General Electric Company, Fairfield, Conn. 06431, and specifying the information desired.

**Grants to education** made by the General Electric Foundation totaled \$4.0 million in 1977. The Foundation maintained its substantial funding of minority education and equal opportunity programs, as well as of science, engineering and technology, and business-societal-governmental relationships programs. Support was again provided to programs designed to reduce youth unemployment.

**GE occupational safety and health** programs were further strengthened, with the goal of anticipating new regulatory developments and establishing procedures for compliance with Federal, state and local requirements and environmental protection standards.

The 124 executives presented at right and on the following pages provide General Electric with managerial leadership in depth.

A further step in the evolution of the Company's management system was completed in 1977, culminating a four-year study by General Electric of how best to meet the long-range growth opportunities and manageability challenges of the next decade.

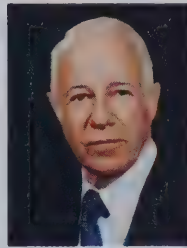
The new structure anticipates that the Company's growth would have led, as new groups were established, to too wide a span of operations reporting to the top level of management. The 1977 realignment establishes a new level of management and planning below the Chairman and Vice Chairmen who make up the Corporate Executive Office. Comprising this level are five operating components called Sectors, with Utah International as a sixth component at Sector level. Sector Executives generally have one or more groups as well as divisions, departments and affiliates reporting to them. The six Sectors are sufficiently broad in scope to accommodate the Company's growth without the necessity of basic restructuring.

New senior corporate staff positions are expected to enhance the contributions of seasoned operating executives in building the Company's strengths in such areas as human and production resources, corporate planning, finance and technology.

Selection of the senior officers for this new organization recognizes the need for management continuity and manpower development, laying the groundwork for the next generation of General Electric management.

## Members of the Corporate Policy Board

Making up this board are, in addition to the Chairman of the Board, the nine officers pictured here.



Walter D. Dance  
Vice Chairman of the Board and Executive Officer



Jack S. Parker  
Vice Chairman of the Board and Executive Officer



Hershner Cross  
Senior Vice President



Robert R. Frederick  
Senior Vice President  
Corporate Planning and Development



Robert B. Kurtz  
Senior Vice President  
Operating Services



Leonard C. Maier, Jr.  
Senior Vice President  
Corporate Relations



Charles E. Reed  
Senior Vice President  
Corporate Technology



Walter A. Schlatterbeck  
Senior Vice President  
General Counsel and Secretary



Alva O. Way  
Senior Vice President  
Finance

## Sector Executives



John F. Burlingame  
Senior Vice President  
and Sector Executive  
International Sector



Stanley C. Gault  
Senior Vice President  
and Sector Executive  
Industrial Products and Components Sector



Edward E. Hood, Jr.  
Senior Vice President  
and Sector Executive  
Technical Systems and Materials Sector



Thomas A. Vanderslice  
Senior Vice President  
and Sector Executive  
Power Systems Sector



John F. Welch, Jr.  
Senior Vice President  
and Sector Executive  
Consumer Products and Services Sector



Alexander M. Wilson  
President and Chief  
Executive Officer  
Utah International Inc.

# Management

## Corporate Policy Board

**Reginald H. Jones**  
Chairman of the Board and  
Chief Executive Officer

**Walter D. Dance**  
Vice Chairman of the  
Board and Executive  
Officer

**Jack S. Parker**  
Vice Chairman of the  
Board and Executive  
Officer

**Hershner Cross**  
Senior Vice President

**Robert R. Frederick**  
Senior Vice President  
Corporate Planning and  
Development

**Robert B. Kurtz**  
Senior Vice President  
Operating Services

**Leonard C. Maier, Jr.**  
Senior Vice President  
Corporate Relations

**Charles E. Reed**  
Senior Vice President  
Corporate Technology

## Sector Executives

**John F. Burlingame**  
Senior Vice President  
and Sector Executive  
International Sector

**Stanley C. Gault**  
Senior Vice President and Sector Executive  
Industrial Products and Components Sector

**Edward E. Hood, Jr.**  
Senior Vice President and Sector Executive  
Technical Systems and Materials Sector

## Operations

### International Sector

**James R. Birlie**  
VP & General Manager  
Far East Area Division

**Willis E. Forsyth**  
VP & General Manager  
Latin American Operations

**Frank D. Kittredge**  
General Manager  
Latin American Business  
Development Division

**Paolo Fresco**  
VP & General Manager  
Africa/Middle East Area  
Division

**Alastair C. Gowan**  
General Manager  
Europe Area Division

**George J. Stathakis**  
VP & General Manager  
International Trading  
Services Operations

**Kristian H. Christiansen**  
VP & General Manager  
International Sales  
Support Division

**Edward F. Roache**  
VP & General Manager  
International  
Construction Division

**Alton S. Cartwright**  
Chairman of the Board &  
Chief Executive Officer  
Canadian General  
Electric Company  
Limited (an affiliate of  
General Electric)

### Industrial Products and Components Sector

**James P. Curley**  
VP & Group Executive  
Industrial Products Group

**Eugene J. Kovarik**  
General Manager  
Motors and Drives  
Division

**Robert J. Rodwell**  
VP & General Manager  
Contractor Equipment  
Division

**Van W. Williams**  
VP & Group Executive  
Component Products  
Group

**George B. Farnsworth**  
VP & General Manager  
Appliance Components  
Division

**Erwin M. Koeritz**  
VP & General Manager  
Electronic Components  
Division

**Ralph B. Glotzbach**  
VP—Industrial Products  
and Components  
Customer and Industry  
Relations Operation

**Fred H. Holt**  
Vice President

**Kertis P. Kuhlman**  
VP & General Manager  
General Electric Supply  
Company Division

**William Longstreet**  
General Manager  
Apparatus Distribution  
Sales Division

**Donald E. Perry**  
VP & General Manager  
Industrial Sales Division

**Carl J. Schlemmer**  
VP & General Manager  
Transportation Systems  
Division

**Peter C. Van Dyck**  
VP & General Manager  
Apparatus Service  
Division

### Technical Systems and Materials Sector

**Charles R. Carson**  
VP & Group Executive  
Engineered Materials  
Group

**Donald E. Debacher**  
VP & General Manager  
Plastics Division

**Donald K. Grierson**  
General Manager  
Metallurgical Division

**Daniel J. Fink**  
VP & Group Executive  
Aerospace Group

**Lee L. Farnham**  
General Manager  
Space Division

**Charles W. George**  
VP & General Manager  
Aircraft Equipment  
Division

**Otto Klima**  
VP & General Manager  
Re-entry and Environ-  
mental Systems Division

**Thomas I. Paganelli**  
VP & General Manager  
Electronic Systems  
Division

**Donald S. Bates**  
General Manager  
Information Services  
Division

**Christopher T. Kastner**  
VP & General Manager  
Mobile Communications  
Division

**Walter L. Robb**  
VP & General Manager  
Medical Systems Division

**Gerhard Neumann**  
VP & Group Executive  
Aircraft Engine Group

**Robert H. Goldsmith**  
VP & General Manager  
Commercial Engine  
Projects Division

**Raymond F. Letts**  
VP & General Manager  
Aircraft Engine  
Manufacturing Division

**Fred O. MacFee, Jr.**  
VP—Aircraft Engine  
Strategic Planning  
Operation

**Brian H. Rowe**  
VP & General Manager  
Aircraft Engine Product  
Engineering Division

**Louis V. Tomasetti**  
VP & General Manager  
Military Engine Projects  
Division

**Edward Woll**  
VP & General Manager  
Aircraft Engine Advanced  
Engineering Division

**James E. Worsham**  
VP & General Manager  
Airline Programs Division

## Corporate Staff Officers

**Michael G. Allen**  
VP—Corporate Strategy

**Edward H. Malone**  
VP—Trust Investments  
Operation

**Thomas O. Thorsen**  
VP & Comptroller

**Arthur M. Bueche**  
VP—Corporate Research  
and Development

**Terence E. McClary**  
VP—Corporate Financial  
Administration

**Steven C. Van Voorhis**  
VP—Northeastern  
Regional Relations

**Thomas R. Casey, M.D.**  
VP & Company  
Medical Director

**John B. McKittrick**  
VP—Corporate  
Development

**Russell E. Whitmyer**  
VP & Treasurer

**Lester W. Dettman**  
VP—East Central  
Regional Relations

**Charles J. Meloun**  
VP—Central Regional  
Relations

**James F. Young**  
VP—Technical  
Resources

**Thomas K. Edenfield**  
VP—Southeastern  
Regional Relations

**Douglas S. Moore**  
VP—Corporate Public  
Relations

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**Walter A. Schlotterbeck**  
Senior Vice President  
General Counsel and  
Secretary

**Alva O. Way**  
Senior Vice President  
Finance

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**Thomas A. Vanderslice**  
Senior Vice President and Sector Executive  
Power Systems Sector

**John F. Welch, Jr.**  
Senior Vice President and Sector Executive  
Consumer Products and Services Sector

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**Power Systems Sector**

**Roy H. Beaton**  
VP & Group Executive  
Nuclear Energy Group

**Donald C. Berkey**  
VP & General Manager  
Energy Systems and  
Technology Division

**Richard W. Kinnard**  
VP & General Manager  
Switchgear and  
Distribution Transformer  
Division

**Arthur E. Peltosalo**  
VP & General Manager  
Power Systems Sales and  
Service Operations

**William R. Tackaberry**  
Vice President  
Power Systems  
Field Sales

**Charles C. Thomas**  
VP & General Manager  
Installation and Service  
Engineering Division

**Bruce O. Roberts**  
VP & General Manager  
Large Transformer  
Division

**Herman R. Hill**  
VP & Group Executive  
Turbine Group

**Edward C. Clark**  
General Manager  
Industrial and Marine  
Steam Turbine Division

**George B. Cox**  
General Manager  
Large Steam Turbine-  
Generator Division

**John A. Urquhart**  
VP & General Manager  
Gas Turbine Division

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**Consumer Products and Services Sector**

**James A. Baker**  
VP & Group Executive  
Lighting Group

**Paul L. Dawson**  
General Manager  
Lamp Components  
Division

**Ralph D. Ketchum**  
VP & General Manager  
Lamp Products Division

**Donald W. Lynch**  
VP & General Manager  
Air Conditioning Division

**Paul W. Van Orden**  
VP & General Manager  
Housewares and Audio  
Division

**John W. Stanger**  
President &  
General Manager  
General Electric  
Credit Corporation  
(an affiliate of General  
Electric)

**Richard O. Donegan**  
VP & Group Executive  
Major Appliance Group

**Donald S. Beilman**  
VP & General Manager  
Major Appliance  
Applied Research  
and Engineering Division

**William B. Clemmens**  
VP—Major Appliance  
Customer and Industry  
Relations Operation

**Robert E. Fowler, Jr.**  
VP & General Manager  
Major Appliance  
Manufacturing Division

**Richard T. Gralton**  
General Manager  
Major Appliance  
Product Management  
Division

**Irving L. Griffin**  
VP & General Manager  
Major Appliance Sales  
and Distribution  
Operations

**Arthur E. Andres**  
VP & General Manager  
Major Appliance  
Contract Sales Division

**Philip J. Drieci**  
VP & General Manager  
Major Appliance  
Retail Sales Division

**Wayman O. Leftwich, Jr.**  
VP & General Manager  
Major Appliance  
Marketing Division

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**Utah International Inc.**

**Edmund W. Littlefield**  
Chairman of the Board

---

**Alexander M. Wilson**  
President and Chief Executive Officer

---

**Utah International Inc.**

**Alf E. Brandin**  
Senior VP & Manager  
Land Development

**James T. Curry**  
Financial VP &  
Treasurer

**J. Bertram Ladd**  
President, Ladd  
Petroleum Corporation  
(a subsidiary of Utah)

**Ralph J. Long**  
Senior VP & Manager  
Australian Operations

**Charles K. McArthur**  
Senior VP & Manager  
Mining Division

**Keith G. Wallace**  
Senior VP & Manager  
Australasia Division

**John S. Anderson**  
VP & Manager  
Domestic Coal  
Operations

**W. Drew Leonard**  
Vice President

**J. Boyd Nielsen**  
VP & Controller

**Boyd C. Paulson**  
VP & Manager  
Construction Services

**George W. Tarleton**  
VP & Manager, Mineral  
Products Marketing

**Robert O. Wheaton**  
VP & Manager  
Exploration

**Timothy R. Winterer**  
VP & General Manager  
Utah Development  
Company (a subsidiary  
of Utah)

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**William B. Frogue**  
VP—Southwestern  
Regional Relations

**J. Russell Mudge**  
VP—Corporate  
Operating Services

**Marion S. Kellogg**  
VP—Corporate  
Consulting Services

**Phillips S. Peter**  
VP—Washington  
Corporate Office

**Harry M. Lawson**  
VP—Western Regional  
Relations

**Donald D. Scarff**  
VP—Atlantic Regional  
Relations

**Theodore P. LeVino**  
VP—Executive  
Manpower

**Cecil S. Semple**  
VP—Corporate  
Customer Relations

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**Bruce T. Mitchell**  
Secretary

**J. Gilbert Selway**  
General Counsel

# GE initiatives on key issues affecting the business environment



Aware that the parameters within which business operates are increasingly set by policies and laws issuing from various levels of government, General Electric's Board of Directors and the six Board Committees challenge GE management to take the lead in speaking out on public issues that affect business. The response of GE management in 1977 is indicated by the summaries of GE positions presented on these pages. Share owners wishing more information on any of these subjects are invited to write to: Investor Relations, General Electric Co., Fairfield, Conn. 06431.

## Turning around business investment: a U.S. need

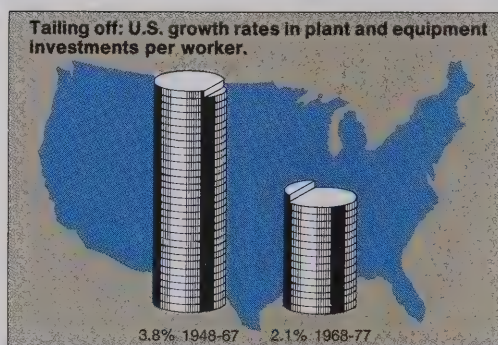
For several decades, U.S. policy has encouraged the consumption and redistribution of our national wealth but has neglected the processes that produce it. Investment in the expansion and modernization of industry has been lagging because the risks inherent in business investment, compounded by inflation, have outweighed the prospects for favorable returns. In fact, industry's real return on investment, after taxes and removing the effects of inflation, has declined from 9.9% in 1965 to about 4% in 1977, and was even lower in the 1974-75 recession.

The result of this deemphasis of production has been an increasing frustration in the nation's quest for its economic and social goals. High rates of inflation, high unemployment levels and an economy that operates below its growth potential all

relate directly to the lag in capital formation and business investment.

While industries in other countries have been, with the strong encouragement of their governments, vigorously upgrading their plant and equipment, the U.S. productive machine grows older, with low rates of productivity improvement and reduced capability to compete.

GE spokesmen have pointed out the long-term slowing in the rate of growth of U.S. capital investment. During the past ten years (1968-77), real business fixed-investment increased at an average annual rate of 2.1%, down from 3.8% per year during the 1948-67 period. With growth in the labor force accelerating, the result has been a slackening in productivity gains — from 2.7% in 1948-67 to 1.6% in 1968-77.



Since the bottom of the recession in 1975, real business fixed-investment has grown at an annual rate of 3½% — only half the rate of previous recoveries. Moreover, the projected rate of business investment for the period ahead is well below the level needed to meet the nation's requirements in terms of energy, productivity, job formation, control of inflation and the funding of social services.

## One solution: constructive tax changes

Changes in tax policies are needed to stimulate the economy, compensate for inflation and encourage capital formation.

Tax cuts both for individuals and for business, as proposed by President Carter, are seen by GE as a good national investment. In the 30-year period 1946-76 there have been ten tax reduction programs. In all cases but one — in 1948 — tax revenues have risen to new highs with a lag of only one year or less because of the resultant economic upsurge.

Meaningful reductions for individuals are called for, in General Electric's view, not only for their economic stimulus but also to offset the fiscal drag on the economy resulting from increased social security taxes, expected energy taxes and the unlegislated tax increases that result when inflation boosts taxpayers into higher brackets.

Tax cuts to stimulate the economy, however, should not mask the need for longer-term revisions in tax policies to encourage capital formation. The present tax structure is sharply tilted against the corporations and the people and institutions that invest in them. The bias in the tax system has contributed to the long-term decline in capital formation in the U.S.

President Carter's proposal to cut the corporate tax rate to 44%, together with the recommendation for the broader application of a permanent and improved investment tax credit, represent important, although modest, steps toward stimulating capital investment and correcting the imbalance in the tax system which favors consumption over investment. In addition, to mitigate the adverse effects of inflation on investment return, the present tax rules with respect to depreciation, a major source of internally generated funds for investment, should be amended to allow shorter capital recovery periods. The climate for investment would also be improved by enactment of legislation reducing or eliminating the double tax on dividends paid to share owners.

GE managers believe that such a tax program would benefit most share owners, stimulate the stock market and make fresh

capital available for business investment, thus helping to achieve the high, sustained level of capital investment needed to provide jobs, increase productivity and maintain U.S. economic vitality.

## Recognizing the U.S. stake in world trade

GE managers take issue with President Carter's proposals to abolish two present tax provisions affecting U.S.-based international businesses: the deferral of American

The percentage of GE domestic jobs dependent on exports has grown from 6% in 1970 to nearly 14% in 1977. Operations of GE overseas affiliates, manufacturing products in host countries, generated 13,000 of these GE jobs in the U.S., plus 16,000 of the jobs among vendors and suppliers.

The benefits that accrue from exports, both in terms of the nation's trade balance and of U.S. jobs, would be jeopardized by eliminating the tax-deferral and DISC provisions. Tax deferrals help overseas operations strengthen their contributions to their host countries and thus increase their effectiveness in "pulling through" export orders. DISC tax measures partially match, for U.S. firms, the support that other countries provide their multinationals. In GE's view, the U.S. can ill afford policies that would further handicap U.S. business in its drive for export sales.

## Transition in energy

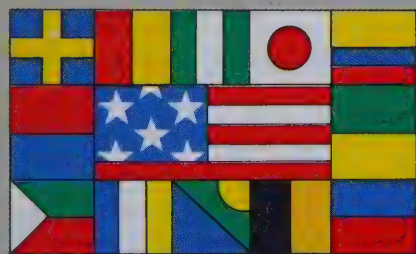
During 1977, energy continued to be a subject of confusion for the American public. Opinion polls indicated that roughly half the public still doubts that energy is a problem of crisis proportions. A mid-1977 poll showed that only about 52% of the public is aware that the U.S. must import *any* oil to satisfy its energy needs.

The facts are that in 1977 the U.S. imported almost half the oil it used. In 1953, Americans paid \$565 million for imported oil. In 1977, the price tag exceeded \$45 billion — the main cause of the huge deficit in the country's balance of trade.

GE executives knowledgeable about the U.S. energy situation spoke out repeatedly during the year to build public awareness of the need and the urgency for changes in U.S. energy supply. Cited particularly was the report of the Workshop on Alternative Energy Strategies sponsored by the Massachusetts Institute of Technology, which reports the results of 2½ years' research by 35 business, government and academic leaders from 15 non-communist countries. In its conclusions the report states that demand for energy will continue to grow despite vigorous conservation policies, and that before the year 2000, oil supplies will fail to meet increasing demand even if energy prices rise 50% above present levels. "The test for the world," the MIT report notes in summary, "will be to manage a transition from oil and gas to greater reliance on other fossil fuels such as coal and on nuclear energy, and, later, on 'renewable energy systems' such as solar and atomic fusion."

GE experts, supporting the report's conclusions, point out the obstacles hindering this transition. The U.S. drive to increase coal use is slowed by conflicting and overlapping regulatory requirements involved in opening new mines, as well as by low productivity in mining and the lack of a suitable infrastructure to handle the increased shipments. Nuclear development is stalled by the present legal, political and regulatory climate involving future cost uncertainties that discourage utilities from planning further nuclear plants. These factors are complicated by unrealistically hopeful projections of energy from such sources as solar, hydro, geothermal and fusion technologies.

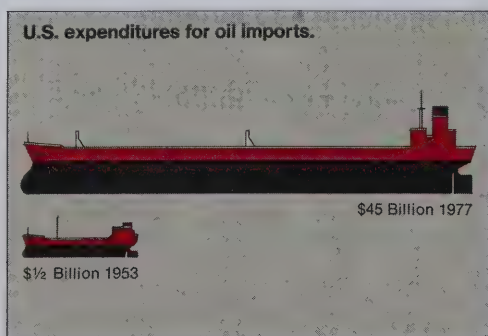
General Electric's position is that the seriousness of the U.S. energy problem requires the active pursuit of *all* promising energy sources, with accelerated use of coal and nuclear power being essential for the rest of this century and until the renewable technologies become economically viable.



taxes on income of overseas subsidiaries until received in the U.S.; and the Domestic International Sales Corporation (DISC), which aids the growth of U.S. exports.

The U.S. is increasingly dependent on world trade. Costs of imports of oil and other basic materials must be balanced to the extent possible by growth in exports. The importance to the nation's employment has been spelled out by President Carter's special representative for trade negotiations: more than one of every five U.S. jobs in manufacturing and one of every three acres in commercial agricultural production are related to export sales.

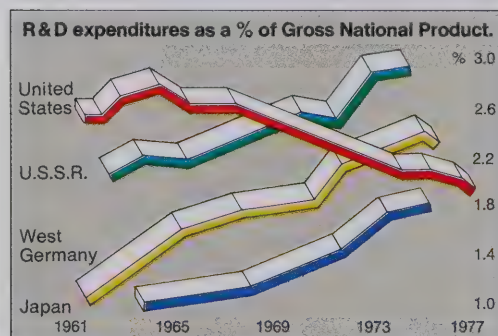
The General Electric record parallels the national experience. A GE study shows the Company's employment increasingly related to foreign trade, including both exports and overseas investments. The study found that the jobs of 37,000 of GE's U.S. employees are dependent on export sales, supporting in turn some 45,000 domestic jobs in supplier and vendor firms.



## Reinvigorating U.S. technology

In addition to its weakness in business investment, the U.S. economy suffers from malnutrition of its technology.

The technological leadership that for decades characterized the U.S. and provided U.S. industry with a competitive



edge in international trade has been eroding. Over the past decade, the percent of U.S. gross national product devoted to research and development has declined — while research in other countries continued to climb.

Industry-funded effort on R&D over most of this period has increased only slightly, and university-performed R&D has remained relatively constant. The main decline has been in Federally-funded R&D activities. Recent increases in Federal spending for R&D are seen by GE observers as encouraging, but after adjustments for inflation the total R&D funding in 1977 was still lower in real terms than ten years earlier.

Moreover, much higher proportions of the total R&D effort in Europe and Japan have been oriented toward civilian economic development.

The effects of this diminishing U.S. support for R&D have begun to show up. Analyses of "major technological innovations" introduced into the commercial market since 1953 show the U.S. lead declining, with West Germany and Japan coming on strongly. Similarly, the U.S. share of patents filed worldwide has de-

clined in the past decade, while U.S. patents granted to foreign inventors has more than doubled.

Studies sponsored by General Electric during the year confirmed the positive correlation between high technology and high growth. Documentation of industry's experience suggests that high-technology industries lead in terms of productivity, growth in employment, success in international trade, and in terms of resistance to price inflation.

Rather than an arbitrary return of research and development spending to the peaks of the 1960s, the goal sought by GE spokesmen is a reversal in the decline in research and development support, with new programs related to the national needs in the decades ahead.

## A constituency for business

If the managers and owners of America's business enterprises are not being sufficiently heard or heeded in the formulation of public policy, the reason lies in large part in the failure to develop a constituency for business — individuals who will speak up for business in the debate on public issues.

While a number of common-interest groups have developed highly influential voices — including farmers, organized labor, consumerists and environmentalists — business enterprise generally commands no such attention.

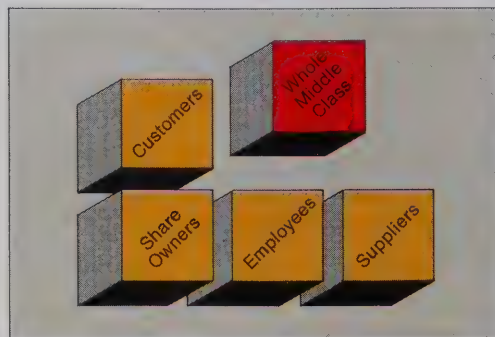
The situation has been aptly summarized by Senator Russell Long: "The

business community, including its stockholders, has a very real stake in legislative decision-making. Yet only a small portion of the correspondence that comes into my office represents the views of this vital sector. This is unfortunate because it means that an important body of opinions is, all too often, neglected in the formulation of government policy. I think that it's time for the business community and the nation's private investors to realize that they have an influential voice. I trust that they will use it in the future."

Investors and savers form a "natural constituency" for business. But a broader base is necessary if the business community is to be more fully and fairly represented. General Electric spokesmen pointed out that only about 25 million, or 12% of the population in the U.S., participated in the direct ownership of stock. For business to have a true natural constituency, it is essential to win the support of all who have a direct pocketbook interest in seeing American business succeed and prosper — including employees, customers, suppliers and, in fact, the whole middle class that works for, buys from and invests in American business.

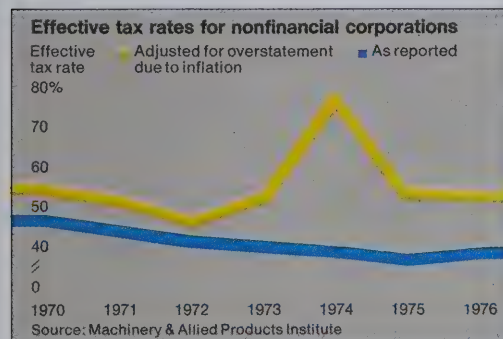
The greater need today is for managers and owners together to reach out to these others and build their awareness of their stake in the welfare of business. Proponents must also be developed among those who are indirect owners of business through their participation in mutual funds, pension funds, insurance policies and the like.

In this continuing effort, GE managers and their staff professionals can be counted on to develop carefully researched proposals on issues such as those summarized in this Annual Report. The support that General Electric's 553,000 share owners can bring in increasing the understanding of others — neighbors, townspeople, fellow employees, newspaper editors and government officials at all levels — will be an invaluable asset.



## Impact of inflation

Inflation's effect should be of concern to all users of financial statements, especially because it can result in an unseen overstatement of profits. This overstatement was noted on an earlier page as being a factor in the decline of industry's *real* rate of return on investment. Just as individual taxpayers feel the effect of the unlegislated tax increases when inflation boosts them into higher brackets without a real increase in income, corporations suffer from a similar malaise. Reported tax rates for nonfinancial corporations have been in the forty percent range for several years, but effective rates, as adjusted for inflation, are considerably higher.



GE management continues to explore all possible avenues of arriving at a solution to the income measurement problems created by inflation, and has cooperated in studies on the subject conducted by the Financial Accounting Standards Board, the American Institute of Certified Public Accountants, and the Financial Executives Research Foundation. Specifically, your management believes that the system of accounting with which we are all familiar — known as “historical cost” — should be retained. Modification of this system, however, could provide for more accurate assessment of inflation's effects. Application of an objective form of inflation-adjusted depreciation and application of last-in first-out (LIFO) inventory accounting—for both financial and income tax

purposes—are two measures that would tend to make provision for maintenance of the physical capital (plant and equipment and inventories) of businesses before any income is reported.

In the meantime, the Securities and Exchange Commission's experiment requiring larger companies to make estimates of “replacement costs” of inventories and fixed assets continues in effect for 1977. As noted in last year's Annual Report, there are serious conceptual and implemental difficulties with the SEC's approach and, despite the SEC's own warnings, there is a tendency for simplistic use of the data. However, the information developed does serve to focus on key problems that inflation poses for business.

In GE's case, the impact on operations of restating reported costs to replacement costs is minimized by use of the LIFO method of accounting for approximately 80% of inventories. With respect to property, plant and equipment, the 1976 Annual Report noted that, using replacement cost techniques, depreciation expense for that year applicable to manufacturing fixed assets would have been approximately \$230 million greater than that reported on a historical cost basis. The comparable adjustment for 1977 is \$260 million. Adding the plant and equipment used by Utah International Inc. in its mineral extractive operations (although not Utah's natural resource assets still in the ground), it is estimated that General Electric's total depreciation expense for 1977 would have been about \$290 million greater than that reported on a historical cost basis.

## Corporate governance

The system of corporate governance, by which businesses remain accountable for their performance, is the target of numerous critics. Because of some unfortunate but highly publicized failures in accountability during the last few years, there are those who urge adoption of sweeping proposals for Federal chartering of, and

greatly increased Federal standards governing, American corporations. As over-reactive as some of the critics may be, it should be recognized that public confidence in business is essential to maintain a healthy and vigorous capital formation process. If the critics are to be proved wrong, then it must be made clear that the present system is alive and workable.

Important facets of the corporate governance issue are the integrity of and responsibility for financial information as well as the conduct of business based on sound principles. Share owners must be reasonably and fairly informed about the financial results of the businesses in which they invest, and they must have confidence that controls are adequate to ensure that the assets represented by their investment are adequately protected. On page 43, there is a Report of Management which addresses these important issues.

## Developing accounting standards

Speaking at a Congressional hearing in April as a Trustee of the Financial Accounting Foundation, the parent organization of the Financial Accounting Standards Board, a Company manager stressed the importance and desirability of keeping responsibility for development of accounting standards in the private sector.

Your management continues to urge strong support of the Financial Accounting Standards Board as the most appropriate mechanism for the development of accounting standards.

# Statement of earnings

General Electric Company and consolidated affiliates

For the years ended December 31 (In millions)	1977	1976	Additional information
<b>Sales of products and services to customers</b> .....	\$17,518.6	\$15,697.3	(note 2)
<b>Operating costs</b> .....			(note 3)
Employee compensation, including benefits .....	6,555.5	5,849.9	(note 4)
Materials, supplies, services and other costs .....	8,753.9	7,726.0	
Depreciation, depletion and amortization .....	522.1	486.2	
Taxes, except those on income .....	239.0	258.8	
Increase in inventories during the year .....	(249.9)	(151.5)	
	<u>15,820.6</u>	<u>14,169.4</u>	
<b>Operating margin</b> .....	1,698.0	1,527.9	
Other income .....	390.3	274.3	(note 5)
Interest and other financial charges .....	<u>(199.5)</u>	<u>(174.7)</u>	(note 6)
<b>Earnings before income taxes and minority interest</b> .....	1,888.8	1,627.5	
Provision for income taxes .....	(773.1)	(668.6)	(note 7)
Minority interest in earnings of consolidated affiliates .....	<u>(27.5)</u>	<u>(28.3)</u>	
<b>Net earnings applicable to common stock</b> .....	<u>\$ 1,088.2</u>	<u>\$ 930.6</u>	
Earnings per common share (in dollars) .....	\$4.79	\$4.12	(note 8)
Dividends declared per General Electric common share (in dollars) .....	\$2.10	\$1.70	
Operating margin as a percentage of sales .....	9.7%	9.7%	
Net earnings as a percentage of sales .....	6.2%	5.9%	

The information on pages 36-45 is an integral part of this statement.

# Statement of financial position

General Electric Company and consolidated affiliates

At December 31 (In millions)	1977	1976	Additional information
<b>Assets</b>			
Cash .....	\$ 1,717.9	\$ 1,059.0	(note 9)
Marketable securities .....	560.3	554.3	(note 9)
Current receivables .....	2,982.7	2,717.3	(note 10)
Inventories .....	2,604.3	2,354.4	(note 11)
<b>Current assets</b> .....	<u>7,865.2</u>	<u>6,685.0</u>	
Property, plant and equipment .....	7,514.5	6,954.8	(note 12)
Accumulated depreciation, depletion and amortization .....	(3,930.4)	(3,598.4)	(note 12)
	<u>3,584.1</u>	<u>3,356.4</u>	(note 12)
Investments .....	1,433.3	1,286.3	(note 13)
Other assets .....	814.2	722.0	(note 14)
<b>Total assets</b> .....	<u>\$13,696.8</u>	<u>\$12,049.7</u>	
<b>Liabilities and equity</b>			
Short-term borrowings .....	\$ 772.1	\$ 611.1	(note 15)
Accounts payable .....	1,021.4	879.7	
Progress collections and price adjustments accrued .....	1,369.7	1,169.7	
Dividends payable .....	125.1	101.7	
Taxes accrued .....	619.9	554.9	
Other costs and expenses accrued .....	1,508.8	1,287.8	(note 16)
<b>Current liabilities</b> .....	<u>5,417.0</u>	<u>4,604.9</u>	
Long-term borrowings .....	1,284.3	1,322.3	(note 17)
Other liabilities .....	921.2	750.6	
<b>Total liabilities</b> .....	<u>7,622.5</u>	<u>6,677.8</u>	
<b>Minority interest in equity of consolidated affiliates</b> .....	<u>131.4</u>	<u>119.0</u>	
Preferred stock (\$1 par value; 2,000,000 shares authorized; none issued) .....	—	—	
Common stock (\$2.50 par value; 251,500,000 shares authorized; 231,410,196 shares issued 1977; 230,368,572 shares issued 1976) .....	578.5	575.9	
Amounts received for stock in excess of par value .....	668.4	618.3	
Retained earnings .....	<u>4,862.5</u>	<u>4,251.2</u>	
	<u>6,109.4</u>	<u>5,445.4</u>	
Deduct common stock held in treasury .....	(166.5)	(192.5)	
<b>Total share owners' equity</b> .....	<u>5,942.9</u>	<u>5,252.9</u>	(notes 18 and 19)
<b>Total liabilities and equity</b> .....	<u>\$13,696.8</u>	<u>\$12,049.7</u>	
Commitments and contingent liabilities .....			(note 20)

The information on pages 36-45 is an integral part of this statement.

# Statement of changes in financial position

General Electric Company and consolidated affiliates

For the years ended December 31 (In millions)	1977	1976
<b>Source of funds</b>		
From operations		
Net earnings .....	\$1,088.2	\$ 930.6
Less earnings retained by nonconsolidated finance affiliates .....	(14.6)	(10.9)
Depreciation, depletion and amortization .....	522.1	486.2
Income tax timing differences .....	(73.4)	(22.5)
Minority interest in earnings of consolidated affiliates .....	27.5	28.3
	<u>1,549.8</u>	<u>1,411.7</u>
Increases in long-term borrowings .....	90.3	156.7
Newly issued common stock .....	54.1	87.4
Increase in current payables other than short-term borrowings .....	651.1	498.0
Other — net .....	<u>248.6</u>	<u>141.7</u>
<b>Total source of funds</b> .....	<u>2,593.9</u>	<u>2,295.5</u>
<b>Application of funds</b>		
Additions to property, plant and equipment .....	822.5	740.4
Dividends declared on General Electric common stock .....	476.9	332.5
Dividends declared on Utah International common stock .....	—	28.3†
Investments .....	147.0	129.7
Reduction in long-term borrowings .....	128.3	73.9
Increase in current receivables .....	265.4	30.1
Increase in inventories .....	<u>249.9</u>	<u>151.5</u>
<b>Total application of funds</b> .....	<u>2,090.0</u>	<u>1,486.4</u>
<b>Net increase in cash, marketable securities, and short-term borrowings</b> .....	<u>\$ 503.9</u>	<u>\$ 809.1</u>
<b>Analysis of net increase in cash, marketable securities, and short-term borrowings</b>		
Increase in cash and marketable securities .....	\$ 664.9	\$ 753.0
Decrease (increase) in short-term borrowings .....	(161.0)	56.1
	<u>\$ 503.9</u>	<u>\$ 809.1</u>

†Reflects transactions prior to date of merger with Utah International (see note 1).

The information on pages 36-45 is an integral part of this statement.

# Statement of changes in share owners' equity

General Electric Company and consolidated affiliates

For the years ended December 31 (Dollar amounts in millions)	1977	1976	1977	1976
<b>Common stock issued</b>			(Thousands of shares)	
Balance January 1 .....	\$ 575.9	\$ 571.8	230,369	228,722
New shares issued:				
Stock options and appreciation rights .....	0.2	0.3	91	137
Employee savings plans .....	2.4	3.8	950	1,510
Balance December 31 .....	<u>578.5</u>	<u>575.9</u>	<u>231,410</u>	<u>230,369</u>
<b>Amounts received for stock in excess of par value</b>				
Balance January 1 .....	618.3	534.7		
Excess over par value of amounts received for newly issued shares..	51.5	83.3		
Gain (loss) on disposition of treasury stock .....	(1.4)	0.3		
Balance December 31 .....	<u>668.4</u>	<u>618.3</u>		
<b>Retained earnings</b>				
Balance January 1 .....	4,251.2	3,681.4		
Net earnings .....	1,088.2	930.6		
Dividends declared on General Electric common stock .....	(476.9)	(332.5)		
Dividends declared on Utah International common stock .....	—	(28.3) †		
Balance December 31 .....	<u>4,862.5</u>	<u>4,251.2</u>		
<b>Common stock held in treasury</b>				
Balance January 1 .....	(192.5)	(171.0)	(3,748)	(3,362)
Purchases .....	(25.9)	(27.1)	(491)	(508)
Dispositions:				
Employee savings plans .....	45.6	—	859	—
Incentive compensation plans .....	6.3	5.5	131	121
Conversion of Overseas Capital Corporation 1985 bonds .....	—	0.1	—	1
Balance December 31 .....	<u>(166.5)</u>	<u>(192.5)</u>	<u>(3,249)</u>	<u>(3,748)</u>
<b>Total share owners' equity December 31</b>	<u>\$5,942.9</u>	<u>\$5,252.9</u>	<u>228,161</u>	<u>226,621</u>

†Reflects transactions prior to date of merger with Utah International (see note 1).  
The information on pages 36-45 is an integral part of this statement.

# Summary of significant accounting policies

## Basis of consolidation

The financial statements consolidate the accounts of the parent General Electric Company and those of all majority-owned and controlled companies ("affiliated companies"), except finance companies whose operations are not similar to those of the consolidated group. All significant items relating to transactions among the parent and affiliated companies are eliminated from the consolidated statements.

The nonconsolidated finance companies are included in the statement of financial position under investments and are valued at equity plus advances. In addition, companies in which GE and/or its consolidated affiliates own 20% to 50% of the voting stock ("associated companies") are included under investments, valued at the appropriate share of equity plus advances. After-tax earnings of nonconsolidated finance companies and associated companies are included in the statement of earnings under other income.

A nonconsolidated uranium mining company (see note 13) is also included under investments and is valued at cost.

## Sales

The Company and its consolidated affiliates record a transaction as a sale only when title to products passes to the customer or when services are performed in accordance with contract terms.

## Vacation expense

Most employees earn credits during the current year for vacations to be taken in the following year. The expense for this liability is accrued during the year vacations are earned rather than in the year vacations are taken.

## Pensions

Investments of the General Electric Pension Trust, which funds the obligations of the General Electric Pension Plan, are carried at amortized cost plus programmed appreciation in the common stock portfolio. Recognition of programmed appreciation is carried out on a systematic basis which does not give undue weight to short-term market fluctuations. Programmed appreciation will not be recognized if average book value, calculated on a moving basis over a multi-year period, exceeds average market value.

The funding program for the Pension Trust uses 6% as the estimated rate of future income. This rate includes systematic recognition of appreciation in the common stock portfolio.

Unfunded liabilities of the Trust are being amortized over a 20-year period. Commencing in 1977, net actuarial gains and losses are being amortized over 15 years rather than being recognized currently.

Costs of a separate, supplementary pension plan, primarily affecting long-service professional and managerial employees, are not funded. Current service costs and amortization of past service costs over a period of 20 years are being charged to Company operating costs currently.

## Investment tax credit

The investment tax credit is recorded by the "deferral method." Under this method the credit is amortized as a reduction of the provision for taxes over the lives of the facilities to which the credit applies, rather than being "flowed through" to income in the year the asset is acquired.

## Inventories

Substantially all manufacturing inventories located in the United States are valued on a last-in first-out, or LIFO, basis. Manufacturing inventories outside the U.S. are generally valued on a first-in first-out, or FIFO, basis. Valuations are based on the cost of material, direct labor and manufacturing overhead, and do not exceed net realizable values. Certain indirect manufacturing expenses are charged directly to operating costs during the period incurred rather than being inventoried.

Mining inventories, which include principally mined ore and coal, metal concentrates, and mining supplies, are stated at the lower of average cost or market. The cost of mining inventories includes both direct and indirect costs consisting of labor, purchased supplies and services, and depreciation, depletion and amortization of property, plant and equipment.

## Property, plant and equipment

Manufacturing plant and equipment includes the original cost of land, buildings and equipment less depreciation, which is the estimated cost consumed by wear and obsolescence. An accelerated depreciation method, based principally on a sum-of-the-years digits formula, is used to record depreciation of the original cost of manufacturing plant and equipment purchased and installed in the United States subsequent to 1960. Acquisitions prior to 1961, and most manufacturing plant and equipment located outside the United States, are depreciated on a straight-line basis. If manufacturing plant and equipment is subject to abnormal economic conditions or obsolescence, additional depreciation is provided. Expenditures for maintenance and repairs of manufacturing plant and equipment are charged to operations as incurred.

The cost of mining properties includes initial expenditures and cost of major rebuilding projects which substantially increase the useful lives of existing assets. The cost of mining properties is depreciated, depleted or amortized over the useful lives of the related assets by use of unit-of-production, straight-line, or declining-balance methods.

Mining exploration costs are expensed until it is determined that the development of a mineral deposit is likely to be economically feasible. After this determination is made, all costs related to further development, including financing costs of identifiable new borrowings associated with the development of new mining projects, are capitalized. Amortization of such costs begins upon commencement of production and is over ten years or the productive life of the property, whichever is less.

Oil and gas properties are accounted for by use of the full cost method. Change to successful efforts accounting to comply with Financial Accounting Standards Board Statement No. 19, effective for years beginning after December 15, 1978, will have an insignificant effect on the Company's operating results and financial position.

# Notes to financial statements

## 1. Data for 1976

As reported in the 1976 Annual Report, a merger with Utah International Inc. ("Utah" or "Utah International") was effected as of December 20, 1976, whereby Utah became a wholly-owned affiliate of General Electric through the exchange of 41,002,034 shares of General Electric \$2.50 par value common stock for all of the outstanding shares of Utah. The principal business of Utah is the extraction and sale of natural resources. The merger was accounted for as a pooling of interests, and accordingly the accompanying financial statements include the accounts of Utah from January 1, 1976.

Effective in 1977, General Electric Credit Corporation adopted Financial Accounting Standards Board Statement No. 13 to account for leases and has restated prior-year results to the revised basis. Amounts included in the condensed financial statements for the Credit Corporation (see note 13) have been restated. Because the restatement is insignificant to General Electric's consolidated earnings and retained earnings for any period, prior-period results of the Company and its consolidated affiliates have not been restated.

## 2. Sales

Approximately one-eighth of sales were to agencies of the U.S. Government, which is the Company's largest single customer. The principal source of these sales was the Technical Systems and Materials segment of the Company's business.

## 3. Operating costs

Operating costs as classified for reporting to the Securities and Exchange Commission are shown below.

(In millions)	1977	1976
Cost of goods sold	\$12,744.4	\$11,481.2
Selling, general and administrative expenses	3,076.2	2,688.2
	<u>\$15,820.6</u>	<u>\$14,169.4</u>

Supplemental details are as follows:

(In millions)	1977	1976
Company-funded research and development	\$463.5	\$411.5
Maintenance and repairs	599.4	535.3
Social security taxes	335.0	302.2
Advertising	219.0	175.5
Rent	156.1	134.6
Mineral royalties and export duties	85.2	125.9

Foreign currency translation gains, after recognizing related income tax effects and minority interest share, were \$7.2 million in 1977 and \$16.6 million in 1976.

## 4. Employee benefits

General Electric and its affiliates have a number of pension plans, the total Company cost of which was \$319.2 million in 1977 and \$240.1 million in 1976. The most significant of these plans is the General Electric Pension Plan, in which substantially all employees in the U.S. are participating. Obligations of the Pension Plan are funded through the GE Pension Trust.

Earnings of the Trust, including the programmed recognition of appreciation, as a percentage of book value of the portfolio were 7.4% for 1977 and 6.4% for 1976.

Unfunded liabilities of the Trust were estimated to be \$732 million at December 31, 1977, compared with \$707 million at the end of 1976. Unfunded vested liabilities included in these amounts were \$596 million and \$568 million at December 31, 1977 and 1976, respectively. The unfunded vested liabilities at December 31, 1977, were equivalent to about 10% of total share owners' equity. Estimated market value of Trust assets at the end of 1977 was \$3,734 million and \$3,636 million at the end of 1976.

Financial statements of the Pension Trust appear below.

### General Electric Pension Trust

(In millions)	1977	1976
<b>Operating statement</b>		
Total assets at January 1	\$3,386.1	\$3,047.5
Company contributions	279.8	204.5
Employee contributions	67.9	59.4
	<u>347.7</u>	<u>263.9</u>
Dividends, interest and sundry income	191.8	144.9
Common stock appreciation:		
Realized	11.1	11.7
Accrued	57.1	76.6
Total programmed	<u>68.2</u>	<u>88.3</u>
Pensions paid	(175.1)	(158.5)
Total assets at December 31	<u>\$3,818.7</u>	<u>\$3,386.1</u>

### Financial position — December 31

U.S. Government obligations and guarantees	\$ 141.7	\$ 103.6
Corporate bonds, notes and mineral interests	322.5	318.0
Real estate and mortgages	735.8	672.3
Common stocks and convertibles	2,431.0	2,177.4
	<u>3,631.0</u>	<u>3,271.3</u>
Cash and short-term investments	141.0	57.4
Other assets — net	46.7	57.4
Total assets	<u>\$3,818.7</u>	<u>\$3,386.1</u>
Funded liabilities:		
Liability to pensioners	\$1,507.7	\$1,265.9
Liability for pensions to participants not yet retired	2,311.0	2,120.2
Total funded liabilities	<u>\$3,818.7</u>	<u>\$3,386.1</u>

Costs of the separate supplementary pension plan were \$12.3 million in 1977 and \$9.5 million in 1976. Unamortized liabilities for this supplementary plan were \$88 million and \$74 million at December 31, 1977 and 1976, respectively.

It is estimated that amendments to the supplementary pension plan effective January 1, 1978, will result in an increase in the unamortized liabilities of approximately \$70 million.

Utah has separate pension plans which are substantially

fully funded and the costs of which are included in the total Company costs reported above.

Incentive compensation plans were participated in by over 3,000 key employees. Amounts included in costs and expenses for incentive compensation were \$44.4 million in 1977 and \$40.1 million in 1976.

## 5. Other income

(In millions)	1977	1976
Net earnings of the Credit Corporation	\$ 67.2	\$ 57.1
Income from:		
Marketable securities and bank deposits	88.2	60.3
Customer financing	46.5	44.6
Associated companies and nonconsolidated uranium mining affiliate	62.2	(2.3)
Royalty and technical agreements	49.5	34.7
Other investments:		
Interest	19.0	20.4
Dividends	10.7	7.7
Other sundry items	47.0	51.8
	<u>\$390.3</u>	<u>\$274.3</u>

Net earnings of the Credit Corporation reflect a minor reclassification for 1976 (see note 1) and the offsetting reclassification is included in other sundry items.

Other income for 1977 includes dividend income from a nonconsolidated uranium mining affiliate. Results for this affiliate formerly were fully consolidated and, therefore, were included in operating margin.

Other sundry items include gains from sales of marketable equity securities of \$22.3 million in 1977 and \$22.9 million in 1976.

## 6. Interest and other financial charges

Amounts applicable to principal items of long-term borrowings were \$94.4 million in 1977 and \$94.5 million in 1976.

## 7. Provision for income taxes

(In millions)	1977	1976
U.S. Federal income taxes:		
Estimated amount payable	\$526.3	\$407.2
Effect of timing differences	(23.3)	(21.7)
Investment credit deferred — net	23.7	13.4
	<u>526.7</u>	<u>398.9</u>
Foreign income taxes:		
Estimated amount payable	272.1	253.5
Effect of timing differences	(50.1)	(0.8)
	<u>222.0</u>	<u>252.7</u>
Other (principally state and local income taxes)	24.4	17.0
	<u>\$773.1</u>	<u>\$668.6</u>

Provision has been made for Federal income taxes to be paid on that portion of the undistributed earnings of affiliates and associated companies expected to be remitted to the parent company. Undistributed earnings intended to be reinvested indefinitely in affiliates and associated companies totaled \$650 million at the end of 1977 and \$579 million at the end of 1976.

## Effect of timing differences on U.S. Federal income taxes

(In millions)	1977	1976
Increase (decrease) in provision for income taxes		
Undistributed earnings of affiliates and associated companies	\$ 19.1	\$ 4.3
Tax over book depreciation	19.0	7.8
Margin on installment sales	(12.4)	2.1
Provision for warranties	(27.1)	(21.6)
Other — net	(21.9)	(14.3)
	<u>\$ (23.3)</u>	<u>\$ (21.7)</u>

Changes in estimated foreign income taxes payable and in the effect of foreign timing differences result principally from recognizing in 1977 for tax payment purposes the results of transactions in Australia and Canada recorded for financial reporting purposes in other periods.

The cumulative net effect of timing differences has resulted in a deferred-tax asset which is shown under other assets.

## Reconciliation of statutory and effective income tax rates

	1977	1976
U.S. Federal statutory rate	48.0%	48.0%
Reduction in taxes resulting from:		
Consolidated affiliate earnings (including DISC) subject to aggregate effective tax rates generally less than 48%	(2.6)	(3.9)
Inclusion of earnings of the Credit Corporation in before-tax income on an "after-tax" basis	(1.8)	(1.7)
Investment credit	(1.1)	(1.2)
Income tax at capital gains rate	(0.7)	(0.9)
Other — net	(0.9)	0.8
Effective tax rate	<u>40.9%</u>	<u>41.1%</u>

All U.S. Federal income tax returns have been closed through 1971 except for the year 1970.

Investment credit amounted to \$43.4 million in 1977, compared with \$31.4 million in the prior year. In 1977, \$19.7 million was added to net earnings, compared with \$18.0 million in 1976. At the end of 1977, the amount still deferred and to be included in net earnings in future years was \$136.2 million.

## 8. Earnings per common share

Earnings per share are based on General Electric average shares outstanding plus, for 1976, outstanding average shares previously reported by Utah multiplied by 1.3. Any dilution which would result from the potential exercise or conversion of such items as stock options or convertible debt outstanding is insignificant (less than 1% in 1977 and 1976).

## 9. Cash and marketable securities

Time deposits and certificates of deposit aggregated \$1,537.1 million at December 31, 1977, and \$875.2 million at December 31, 1976. Deposits restricted as to usage and withdrawal or used as partial compensation for short-term borrowing arrangements were not material.

Marketable securities (none of which are equity securities) are carried at the lower of amortized cost or market value. Carrying value was substantially the same as market value at year-end 1977 and 1976. Included at year-end 1977 were U.S. treasury obligations of \$371.4 million (\$337.9 million in 1976).

## 10. Current receivables

(In millions)	December 31	1977	1976
Customers' accounts and notes		\$2,576.0	\$2,330.1
Associated companies		88.5	87.5
Nonconsolidated affiliates		1.6	2.1
Other		<u>384.2</u>	<u>353.4</u>
		3,050.3	2,773.1
Less allowance for losses		<u>(67.6)</u>	<u>(55.8)</u>
		<u>\$2,982.7</u>	<u>\$2,717.3</u>

## 11. Inventories

(In millions)	December 31	1977	1976
Raw materials and work in process		\$1,629.0	\$1,529.6
Finished goods		808.9	700.7
Unbilled shipments		<u>166.4</u>	<u>124.1</u>
		<u>\$2,604.3</u>	<u>\$2,354.4</u>

About 80% of total inventories are in the United States.

If the FIFO method of inventory accounting had been used by the Company, inventories would have been \$1,294.9 million higher than reported at December 31, 1977 (\$1,160.8 million higher than reported at December 31, 1976).

## 12. Property, plant and equipment

(In millions)	1977	1976
Major classes at December 31:		
Manufacturing plant and equipment		
Land and improvements	\$ 121.0	\$ 111.7
Buildings, structures and related equipment	1,878.5	1,770.5
Machinery and equipment	4,305.4	3,930.1
Leasehold costs and manufacturing plant under construction	166.5	180.3
Mineral property, plant and equipment	<u>1,043.1</u>	<u>962.2</u>
	<u>\$7,514.5</u>	<u>\$6,954.8</u>
Cost at January 1	\$6,954.8	\$6,501.4
Additions	822.5	740.4
Dispositions	<u>(262.8)</u>	<u>(287.0)</u>
Cost at December 31	<u>\$7,514.5</u>	<u>\$6,954.8</u>

## Accumulated depreciation, depletion and amortization

Balance at January 1	\$3,598.4	\$3,320.5
Current-year provision	522.1	486.2
Dispositions	<u>(174.0)</u>	<u>(202.1)</u>
Other changes	<u>(16.1)</u>	<u>(6.2)</u>
Balance at December 31	<u>\$3,930.4</u>	<u>\$3,598.4</u>

## Property, plant and equipment less depreciation, depletion and amortization at December 31

	<u>\$3,584.1</u>	<u>\$3,356.4</u>
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## 13. Investments

(In millions)	December 31	1977	1976
Nonconsolidated finance affiliates		\$ 605.2	\$ 552.9
Nonconsolidated uranium mining affiliate		<u>86.7</u>	<u>86.7</u>
Miscellaneous investments (at cost):			
Government and government-guaranteed securities		269.3	248.0
Other		<u>105.8</u>	<u>72.4</u>
		<u>375.1</u>	<u>320.4</u>
Marketable equity securities:			
Honeywell Inc. and Honeywell Information Systems Inc.		20.4	77.1
Other		<u>37.7</u>	<u>39.9</u>
		<u>58.1</u>	<u>117.0</u>
Associated companies		<u>322.8</u>	<u>223.9</u>
Less allowance for losses		<u>(14.6)</u>	<u>(14.6)</u>
		<u>\$1,433.3</u>	<u>\$1,286.3</u>

## General Electric Credit Corporation Financial position

(In millions)	December 31	1977	1976
Cash and marketable securities		\$ 278.6	\$ 233.9
Receivables:			
Time sales and loans		4,914.8	4,407.1
Deferred income		<u>(686.7)</u>	<u>(638.7)</u>
		4,228.1	3,768.4
Investment in leases		922.1	839.1
Sundry receivables		<u>67.0</u>	<u>58.5</u>
Total receivables		5,217.2	4,666.0
Allowance for losses		<u>(178.1)</u>	<u>(142.9)</u>
Net receivables		<u>5,039.1</u>	<u>4,523.1</u>
Other assets		<u>217.0</u>	<u>151.5</u>
Total assets		<u>\$5,534.7</u>	<u>\$4,908.5</u>
Notes payable:			
Due within one year		\$2,345.1	\$2,164.1
Long-term — senior		1,382.8	1,186.9
— subordinated		<u>325.5</u>	<u>276.6</u>
Other liabilities		<u>361.4</u>	<u>312.3</u>
Total liabilities		4,414.8	3,939.9
Deferred income taxes		<u>520.7</u>	<u>420.8</u>
Capital stock		381.9	344.2
Additional paid-in capital		11.5	11.5
Retained earnings		<u>205.8</u>	<u>192.1</u>
Equity		<u>599.2</u>	<u>547.8</u>
Total liabilities, deferred income taxes and equity		<u>\$5,534.7</u>	<u>\$4,908.5</u>

## Current and retained earnings

(In millions)	For the year	1977	1976
Earned income		\$ 656.6	\$ 597.3
Expenses:			
Interest and discount		237.8	219.9
Operating and administrative		259.9	222.2
Provision for losses — receivables		76.1	72.0
— other assets		<u>(2.0)</u>	<u>15.3</u>
Provision for income taxes		<u>17.6</u>	<u>10.8</u>
		<u>589.4</u>	<u>540.2</u>
Net earnings		67.2	57.1
Less dividends		<u>(53.5)</u>	<u>(47.5)</u>
Retained earnings at January 1		192.1	182.5
Retained earnings at December 31		<u>\$ 205.8</u>	<u>\$ 192.1</u>

Shown above are the condensed consolidated financial statements for the General Electric Credit Corporation (the principal

nonconsolidated finance affiliate), including the effect of adopting Financial Accounting Standards Board Statement No. 13 to account for leases.

More detailed information is available in General Electric Credit Corporation's 1977 Annual Report, copies of which may be obtained by writing to: General Electric Credit Corporation, P.O. Box 8300, Stamford, Conn. 06904.

Advances to nonconsolidated finance affiliates aggregated \$0.7 million at the end of 1977 and 1976.

Investment in the nonconsolidated uranium mining affiliate consists of investment in a wholly-owned affiliate (established in the course of obtaining a U.S. Department of Justice Business Advisory Clearance Procedure Letter in connection with the 1976 Utah merger) to which all uranium business of Utah has been transferred. All common stock of this affiliate has been placed in a voting trust controlled by independent voting trustees. Prior to the year 2000, General Electric and its affiliates may not withdraw the common stock from the voting trust except for sale to unaffiliated third parties. Directors and officers of the affiliate may not be directors, officers, or employees of General Electric, Utah or of any of their affiliates. Uranium may not be sold by this affiliate, in any state or form, to, or at the direction of, General Electric or its affiliates.

All outstanding shares of preferred stock of the uranium affiliate are retained by Utah as an affiliate of General Electric. Payment of cumulative quarterly dividends out of legally available funds on this preferred stock is mandatory in amounts equal to 85% of the affiliate's net after-tax income for the previous quarter (without taking account of any deduction for exploration expense as defined). Utah, as holder of the preferred stock, must make loans with up to 10-year maturities when requested by the affiliate, provided that the aggregate amount of such loans does not at any time exceed preferred dividend payments for the immediately preceding two calendar years.

The estimated realizable value of miscellaneous investments at December 31, 1977, was \$370 million (\$310 million at December 31, 1976).

Marketable equity securities are valued at the lower of cost or market. Aggregate market value of marketable equity securities was \$129 million and \$209 million at year-end 1977 and 1976, respectively. At December 31, 1977, gross unrealized gains on marketable equity securities were \$71 million.

Market value calculations for equity securities include the Company's investment in Honeywell Information Systems Inc. (HIS) as being equivalent to 1,400,000 shares of Honeywell Inc. common stock at December 31, 1976. Cost of the investment in Honeywell Inc. and HIS is the appraised fair value recorded on October 1, 1970, when the General Electric information systems equipment business was transferred to HIS. The recorded value is less than tax cost.

General Electric held an 11.7% ownership in HIS at December 31, 1976. In 1977, in accordance with an Agreement between General Electric and Honeywell, Honeywell purchased GE's remaining HIS interest for 1,400,000 shares of Honeywell stock.

At December 31, 1977, GE held 524,000 shares of Honeywell common stock, compared with 584,000 shares at December 31, 1976. GE sold 1,460,000 shares of Honeywell common stock in 1977 and 596,800 shares in 1976. Average cost was used to determine the amount of realized gains

entering into the determination of net income.

General Electric is committed to the U.S. Department of Justice to dispose of its year-end 1977 holding of Honeywell common stock by December 31, 1980.

A voting trust has been established in which General Electric has deposited all shares of Honeywell common stock received as part of these transactions.

#### 14. Other assets

(In millions)	December 31	1977	1976
Long-term receivables		\$332.7	\$322.0
Deferred income taxes		118.0	59.4
Customer financing		80.9	89.5
Deferred charges		78.5	60.6
Real estate development projects		75.0	71.0
Recoverable engineering costs on government contracts		65.1	55.4
Licenses and other intangibles — net		33.1	29.5
Other		30.9	34.6
		<u>\$814.2</u>	<u>\$722.0</u>

Licenses and other intangibles acquired after October 1970 are being amortized over appropriate periods of time.

#### 15. Short-term borrowings

The average balance of short-term borrowings, excluding the current portion of long-term borrowings, was \$663.5 million during 1977 (calculated by averaging all month-end balances for the year) compared with an average balance of \$573.3 million in 1976. The maximum balance included in these calculations was \$738.3 million and \$606.0 million at the end of November 1977 and July 1976, respectively. The average effective interest rate for the year 1977 was 13.2% and for 1976 was 11.6%. These average rates represent total short-term interest expense divided by the average balance outstanding. A summary of short-term borrowings and the applicable interest rates is shown below.

#### Short-term borrowings

(In millions)	December 31	1977		1976	
	Amount	Average rate at Dec. 31		Amount	Average rate at Dec. 31
Parent notes with Trust Departments	\$309.0	6.85%		\$310.9	4.73%
Consolidated affiliates:					
Banks	308.0	22.23		201.2	22.82
Commercial paper	—	—		6.3	9.50
Other, including current portion of long-term borrowings	155.1			92.7	
	<u>\$772.1</u>			<u>\$611.1</u>	

Parent borrowings are from U.S. sources. Borrowings of consolidated affiliated companies are primarily from foreign sources. Other borrowings include amounts from non-consolidated affiliates of \$65.7 million in 1977 (\$9.5 million in 1976).

Although the total unused credit available to the Company through banks and commercial credit markets is not readily quantifiable, informal credit lines in excess of \$1 billion had been extended by approximately 123 U.S. banks at year end.

## 16. Other costs and expenses accrued

The balance at the end of 1977 included compensation and benefit costs accrued of \$532.7 million and interest expense accrued of \$31.5 million. At the end of 1976, compensation and benefit costs accrued were \$453.9 million and interest expense accrued was \$30.5 million.

## 17. Long-term borrowings

(In millions)				Due date	Sinking fund/ pre-payment period
Outstanding	December 31	1977	1976		
General Electric Company:					
6¼ % Debentures	\$	125.0	\$ 125.0	1979	None
5¾ % Notes		81.3	87.5	1991	1972-90
5.30% Debentures		113.3	123.3	1992	1973-91
7½ % Debentures		171.0	179.2	1996	1977-95
8½ % Debentures		300.0	300.0	2004	1985-03
Utah International Inc:					
7½ % Guaranteed Notes		20.0	20.0	1979	None
Notes with banks		104.4	115.1	1985	1977-85
Assoc. company note		29.1	27.1	1986	1981-86
8% Guaranteed Sinking Fund Debentures		19.2	19.6	1987	1977-87
7.6% Notes		40.0	43.0	1988	1974-88
Other		7.8	9.5		
General Electric Overseas Capital Corporation:					
4¼ % Bonds		29.8	31.9	1985	1976-84
4¼ % Debentures		50.0	50.0	1987	None
5½ % Sterling/Dollar Guaranteed Loan Stock		6.8	6.1	1993	None
Other		59.0	49.1		
All other		127.6	135.9		
		<u>\$1,284.3</u>	<u>\$1,322.3</u>		

The amounts shown above are after deduction of the face value of securities held in treasury as shown below.

### Face value of long-term borrowings in treasury

(In millions)	December 31	1977	1976
General Electric Company:			
5.30% Debentures		\$36.7	\$36.7
7½ % Debentures		21.8	20.8
General Electric Overseas Capital Corporation:			
4¼ % Bonds		5.1	4.9

During 1977, General Electric 5.30% Debentures having a face value of \$10.0 million (\$10.0 million in 1976) and a reacquired cost of \$7.6 million (\$8.2 million in 1976), and General Electric 7½ % Debentures having a face value of \$7.2 million and a reacquired cost of \$6.6 million were retired in accordance with sinking fund provisions. General Electric 5¾ % Notes having a face value of \$6.2 million (\$6.2 million in 1976) were retired in accordance with prepayment provisions.

Utah International Inc. notes with banks are payable in varying installments to 1985 and were subject to average interest rates at year-end 1977 and 1976 of 7.7% and 6.7%, respectively. Interest rate on associated company note varies (7.1% and 7.2% at year-end 1977 and 1976, respectively).

Borrowings of General Electric Overseas Capital Corporation are unconditionally guaranteed by General Electric as to payment of principal, premium if any, and interest. This Corporation primarily assists in financing capital requirements of foreign companies in which General Electric has an equity interest, as well as financing certain customer purchases. Borrowings include 4¼ % Guaranteed Debentures due in 1987, which are convertible until June 15, 1987, into General Electric common stock at \$80.75 a share, and 5½ % Sterling/Dollar Guaranteed Loan Stock due in 1993 in the amount of £3.6 million (\$6.8 million), convertible from October 1976 into General Electric common stock at \$73.50 a share. During 1977, General Electric Overseas Capital Corporation 4¼ % Guaranteed Bonds having a face value of \$1.9 million (\$2.0 million in 1976) and a reacquired cost of \$1.4 million (\$1.4 million in 1976) were retired in accordance with sinking fund provisions.

All other long-term borrowings were largely by foreign and real estate development affiliates with various interest rates and maturities.

Long-term borrowing maturities during the next five years, including the portion classified as current, are \$75.1 million in 1978, \$197.3 million in 1979, \$70.6 million in 1980, \$59.4 million in 1981 and \$70.9 million in 1982. These amounts are after deducting reacquired debentures held in treasury for sinking fund requirements.

## 18. Share owners' equity

Common stock held in treasury at December 31, 1977, included 1,491,515 shares for the deferred compensation provisions of incentive compensation plans (1,443,110 shares at December 31, 1976). These shares are carried at market value at the time of allotment, which amounted to \$73.2 million and \$70.0 million at December 31, 1977 and 1976, respectively. The liability is recorded under other liabilities. Other common stock in treasury, which is carried at cost, aggregated 1,758,055 and 2,304,794 shares at December 31, 1977 and 1976, respectively. These shares are held for future corporate requirements, including distributions under employee savings plans, incentive compensation awards and possible conversion of General Electric Overseas Capital Corporation convertible indebtedness. The maximum number of shares required for conversions was 737,725 at December 31, 1977 and 1976. Corporate requirements of shares for benefit plans and conversions may be met either from unissued shares or from shares in treasury.

Retained earnings at year-end 1977 included approximately \$216.7 million representing the excess of earnings of nonconsolidated affiliates over dividends received since their formation. In addition, retained earnings have been increased by \$63.2 million, which represents the change in equity in associated companies since acquisition. At the end of 1976, these amounts were \$204.3 million and \$47.3 million, respectively.

## 19. Stock option and stock appreciation rights plans

The plan approved by the share owners in 1973, and previous plans under which options remain outstanding, provide continuing incentives for more than 500 employees. Option price under these plans is the full market value of GE common stock

on date of grant. Employees can only exercise options to the extent that annual installments have matured, normally over a period of nine years. The 1973 plan also provides for granting stock appreciation rights to holders of options under present and past plans which permit them to surrender exercisable options or a portion of an option in exchange for an amount equal to the excess of the market price of the common stock on the date the right is exercised over the option price. The Management Development and Compensation Committee of the Board of Directors determines whether this amount will be distributed in General Electric shares, cash or both.

At the end of 1977, there were 2,458,515 shares reserved for the 1973 plan and 1,169,185 shares covered by outstanding options granted under prior plans, for a total of 3,627,700 shares. Of this total amount, 1,402,655 shares were subject to exercisable options, 1,986,278 shares were under options not yet exercisable, and 238,767 shares were available for granting options in the future. Appreciation rights relating to unexpired options for 1,151,190 and 972,294 shares were outstanding at December 31, 1977 and 1976, respectively. The number of shares available for granting options at the end of 1976 was 903,109. A summary of stock option transactions during the last two years is shown below.

#### Stock options

	Shares subject to option	Average per share	
		Option price	Market price
Balance at Jan. 1, 1976	3,058,217	\$50.69	\$46.13
Options granted	316,053	52.62	52.62
Options exercised	(133,542)	45.25	53.42
Options surrendered on exercise of appreciation rights	(21,987)	46.08	53.56
Options terminated	(236,639)	52.92	—
Balance at Dec. 31, 1976	2,982,102	51.00	55.63
Options granted	695,693	51.56	51.56
Options exercised	(91,572)	44.55	52.75
Options surrendered on exercise of appreciation rights	(51,950)	43.17	53.36
Options terminated	(145,340)	54.39	—
Balance at Dec. 31, 1977	<u>3,388,933</u>	51.26	49.75

#### 20. Commitments and contingent liabilities

Lease commitments and contingent liabilities, consisting of guarantees, pending litigation, taxes and other claims, in the opinion of management, are not considered to be material in relation to the Company's financial position.

## Unaudited notes to financial statements

### A. Operations by quarter for 1977 and 1976 (unaudited)

A summary of certain information pertaining to operating results for each quarter of calendar years 1977 and 1976 is shown below.

(Dollar amounts in millions; per-share amounts in dollars)	First quarter	Second quarter	Third quarter	Fourth quarter
1977:				
Sales of products and services to customers	\$4,063.0	\$4,383.3	\$4,348.7	\$4,723.6
Operating margin	356.7	420.1	440.8	480.4
Net earnings	215.4	271.9	268.5	332.4
Net earnings per common share	0.95	1.20	1.18	1.46
1976:				
Sales of products and services to customers	\$3,483.5	\$3,917.0	\$3,774.3	\$4,522.5
Operating margin	295.9	375.4	376.5	480.1
Net earnings	172.5	238.6	227.3	292.2
Net earnings per common share	0.77	1.05	1.01	1.29

### B. Estimated current replacement cost of certain assets and certain costs and expenses (unaudited)

In inflationary periods the cost of replacing certain assets, such as plant and equipment and inventories, with equivalent productive capacity or goods is generally higher than the cost incurred when such assets were originally acquired. The Securities and Exchange Commission (SEC) requires that estimates be made of replacement costs for certain assets and the effect of the assumed replacement on certain costs and expenses. In accordance with the SEC's requirement, the Company has made such estimates and will include them in its "10-K Report" to be filed with that agency at the end of March 1978. For further information about the impact of inflation, see page 31 of this Report.

# Report of management

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To the Share Owners of  
General Electric Company

We have prepared the accompanying statement of financial position of General Electric Company and consolidated affiliates as of December 31, 1977 and 1976, and the related statements of earnings, changes in financial position and changes in share owners' equity for the years then ended, including the notes and industry and geographic segment information. The statements have been prepared in conformity with generally accepted accounting principles appropriate in the circumstances, and include amounts that are based on our best estimates and judgments. Financial information elsewhere in this Annual Report is consistent with that in the financial statements.

Your Company maintains a strong system of internal financial controls and procedures, supported by a corporate staff of traveling auditors and supplemented by resident auditors located around the world. This system is time-tested, innovative and responsive to change. Perhaps the most important safeguard in this system for share owners is the fact that the Company has long emphasized the selection, training and development of professional financial managers to implement and oversee the proper application of its internal controls and the reporting of management's stewardship of corporate assets and maintenance of accounts in conformity with generally accepted accounting principles.

The independent public accountants provide an objective, independent review as to management's discharge of its responsibilities insofar as they relate to the fairness of reported operating results and financial condition. They obtain and maintain an understanding of GE's accounting and financial

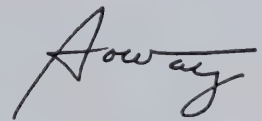
controls, and conduct such tests and related procedures as they deem necessary to arrive at an opinion on the fairness of financial statements.

The Audit Committee of the Board of Directors, composed solely of outside directors, meets with the independent public accountants, management and internal auditors periodically to review the work of each and ensure that each is properly discharging its responsibilities. The independent public accountants have free access to this Committee, without management present, to discuss the results of their audit work and their opinions on the adequacy of internal financial controls and the quality of financial reporting.

Your management has long recognized responsibility for conducting the Company's affairs in a manner which is responsive to the ever-increasing complexity of society. This responsibility is reflected in key Company policy statements regarding, among other things, potentially conflicting outside business interests of Company employees, proper conduct of domestic and international business activities, and compliance with antitrust laws. Educational, communication, and review programs are designed to ensure that these policies are clearly understood and that there is awareness that deviation from them will not be tolerated.



Chairman of the Board  
and Chief Executive Officer  
February 17, 1978



Senior Vice President  
Finance

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## Report of independent certified public accountants

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To the Share Owners and Board of Directors of  
General Electric Company

We have examined the statement of financial position of General Electric Company and consolidated affiliates as of December 31, 1977 and 1976, and the related statements of earnings, changes in financial position and changes in share owners' equity for the years then ended. Our examinations were made in accordance with generally accepted auditing standards, and accordingly included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion, the aforementioned financial statements present fairly the financial position of General Electric Company and consolidated affiliates at December 31, 1977 and 1976, and the results of their operations and the changes in their financial position for the years then ended, in conformity with generally accepted accounting principles applied on a consistent basis.



Peat, Marwick, Mitchell & Co.  
345 Park Avenue, New York, N.Y. 10022  
February 17, 1978

# Industry segment information

(In millions)

## Revenues

For the years ended December 31

	Total revenues		Intersegment sales		External sales and other income	
	1977	1976	1977	1976	1977	1976
Consumer products and services	\$ 4,148.1	\$ 3,452.6	\$ 181.9	\$157.8	\$ 3,966.2	\$ 3,294.8
Industrial products and components	3,698.1	3,269.8	431.5	395.8	3,266.6	2,874.0
Power systems	3,217.6	2,998.4	153.9	151.6	3,063.7	2,846.8
Technical systems and materials	4,144.6	3,688.6	148.0	118.1	3,996.6	3,570.5
Utah International Inc.	965.1	1,002.9	—	—	965.1	1,002.9
Foreign multi-industry operations	2,562.1	2,333.6	49.4	41.0	2,512.7	2,292.6
Net earnings of GE Credit Corp.	67.2	57.1	—	—	67.2	57.1
General corporate items and eliminations	(893.9)	(831.4)	(964.7)	(864.3)	70.8	32.9
Total	<u>\$17,908.9</u>	<u>\$15,971.6</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$17,908.9</u>	<u>\$15,971.6</u>

## Segment operating profit

For the years ended December 31

	1977	1976
Consumer products and services	\$ 482.8	\$ 397.1
Industrial products and components	366.7	302.4
Power systems	162.7	154.4
Technical systems and materials	473.7	399.3
Utah International Inc.	389.2	359.7
Foreign multi-industry operations	210.8	201.0
Net earnings of GE Credit Corp.	67.2	57.1
Total segment operating profit	2,153.1	1,871.0
General corporate items and eliminations	(64.8)	(68.8)
Interest and other financial charges	(199.5)	(174.7)
Total	<u>\$1,888.8</u>	<u>\$1,627.5</u>

## Net earnings

For the years ended December 31

	1977	1976
Consumer products and services	\$ 255.9	\$203.5
Industrial products and components	191.1	160.4
Power systems	75.5	61.4
Technical systems and materials	247.5	201.3
Utah International Inc.	196.2	181.3
Foreign multi-industry operations	70.6	74.7
Net earnings of GE Credit Corp.	67.2	57.1
Total	<u>\$1,088.2</u>	<u>\$930.6</u>

## Assets

At December 31

	1977	1976
Consumer products and services	\$ 1,791.9	\$ 1,643.7
Industrial products and components	1,925.1	1,726.9
Power systems	2,152.8	2,153.8
Technical systems and materials	2,128.3	1,896.0
Utah International Inc.	1,386.0	1,235.5
Foreign multi-industry operations	1,849.0	1,654.3
Investment in GE Credit Corp.	600.0	548.5
General corporate items and eliminations	1,863.7	1,191.0
Total	<u>\$13,696.8</u>	<u>\$12,049.7</u>

## Property, plant and equipment

For the years ended December 31

	Additions		Depreciation, depletion & amortization	
	1977	1976	1977	1976
Consumer products and services	\$127.0	\$ 86.3	\$101.0	\$ 95.5
Industrial products and components	147.7	115.0	83.8	77.3
Power systems	81.6	72.0	73.2	79.6
Technical systems and materials	203.8	176.5	126.3	110.2
Utah International Inc.	131.6	213.6	66.9	67.5
Foreign multi-industry operations	115.9	69.6	52.7	41.0
Investment in GE Credit Corp.	—	—	—	—
General corporate items and eliminations	14.9	7.4	18.2	15.1
Total	<u>\$822.5</u>	<u>\$740.4</u>	<u>\$522.1</u>	<u>\$486.2</u>

**Consumer products and services** consists of major appliances (which also includes appliance service), air conditioning equipment, lighting products, housewares and audio products and services, television receivers and broadcasting and cablevision services.

**Industrial products and components** includes components (appliance controls, small motors and electronic components); industrial capital equipment (construction, automa-

tion, and transportation); maintenance, inspection, repair and rebuilding of electric and mechanical apparatus; and a network of supply houses offering products of General Electric and other manufacturers.

**Power systems** includes steam turbine-generators, gas turbines, nuclear power reactors and nuclear fuel assemblies, transformers, switchgear, meters, and installation and maintenance engineering services.

**Technical systems and materials** consists of jet engines for aircraft, industrial and marine applications; electronic and other high-technology products and services primarily for space applications and national defense; materials (engineering plastics, silicones, industrial cutting materials, laminated and insulating materials, and batteries); medical and communications equipment; and time sharing, computing, and remote data processing.

**Utah International Inc.** is engaged in mining coking coal (principally in Australia), uranium, steam coal, iron, and copper. In addition, Utah engages in oil and natural gas production, ocean shipping (primarily in support of mining operations) and land acquisition and development.

**Foreign multi-industry operations** consist principally of foreign affiliates who manufacture products primarily for sale in their respective home markets.

**General Electric Credit Corporation**, a wholly-owned nonconsolidated finance affiliate, engages primarily in consumer, commercial and industrial financing, principally in

the United States. Products of companies other than General Electric constitute a major portion of products financed by GECC.

In general, it is the Company's policy to price internal sales as nearly as practicable to equivalent commercial selling prices.

In computing net earnings, general corporate expenses and interest and other financial charges have been allocated to the industry segments. General corporate expenses are allocated principally on the basis of cost of operations, with certain exceptions and reductions which recognize the varying degrees to which affiliated companies maintain their own corporate structures. Interest and other financial charges are allocated to parent company components based principally on cash flow, and affiliated companies generally service their own debt. In addition, provision for income taxes (\$773.1 million in 1977, \$668.6 million in 1976) is allocated based on the total corporate effective tax rate, except for the Credit Corporation and Utah whose income taxes are calculated separately. Minority interest (\$27.5 million in 1977, \$28.3 million in 1976) is allocated to operating components having responsibility for investments in consolidated affiliates.

## Geographic segment information

(In millions)

### Revenues

For the years ended December 31

	Total revenues		Intersegment sales		External sales and other income	
	1977	1976	1977	1976	1977	1976
United States	\$14,560.4	\$12,878.9	\$340.3	\$274.5	\$14,220.1	\$12,604.4
Far East including Australia	1,056.2	1,040.0	204.0	132.3	852.2	907.7
Other areas of the world	2,916.7	2,564.6	80.1	105.1	2,836.6	2,459.5
Elimination of intracompany transactions	(624.4)	(511.9)	(624.4)	(511.9)	—	—
Total	<u>\$17,908.9</u>	<u>\$15,971.6</u>	<u>\$ —</u>	<u>\$ —</u>	<u>\$17,908.9</u>	<u>\$15,971.6</u>

Included in United States revenues were export sales to unaffiliated customers of \$2,101.2 million in 1977 and \$1,914.5 million in 1976. Of such sales, \$1,216.9 million in 1977

(\$1,179.7 million in 1976) were to customers in Europe, Africa and the Middle East; and \$574.2 million in 1977 (\$371.9 million in 1976) were to customers in the Far East and Australia.

### Net earnings

For the years ended December 31

	1977	1976
United States	\$ 846.3	\$633.2
Far East including Australia	161.6	194.5
Other areas of the world	83.5	103.5
Elimination of intracompany transactions	(3.2)	(0.6)
Total	<u>\$1,088.2</u>	<u>\$930.6</u>

### Assets

At December 31

	1977	1976
United States	\$10,491.5	\$ 9,262.6
Far East including Australia	871.2	792.7
Other areas of the world	2,414.8	2,069.0
Elimination of intracompany transactions	(80.7)	(74.6)
Total	<u>\$13,696.8</u>	<u>\$12,049.7</u>

Revenues, net earnings, and assets associated with foreign operations are shown in the tabulation above. At December 31, 1977, foreign operation liabilities, minority interest in equity and GE interest in equity were \$1,798.7 million, \$131.3

million and \$1,356.0 million, respectively. On a comparable basis at December 31, 1976, foreign operation liabilities, minority interest in equity and GE interest in equity were \$1,520.1 million, \$118.9 million and \$1,222.7 million, respectively.

## Management's discussion and analysis

The financial statements and notes provide detailed information about operating results, financial position, changes therein, and industry and geographic segments for the years 1977 and 1976. At the right is a ten-year summary which provides historical perspective. In addition, operating results for 1977 compared with 1976 are discussed by industry segment, and revenues and net earnings by industry segment are summarized for the last five years on pages 6-20 of this Report.

As used in this Report, "revenues" consist of sales of products and services to customers and other income from external sources. Because of the diversity of the Company's business, comments about the impact of physical volume and selling prices on year-to-year changes in sales can only be generalized. However, it is estimated that greater volume accounted for somewhat more than half of the increase of \$1.8 billion (12%) from 1976 to 1977. From 1975 to 1976, sales increased \$1.6 billion (11%), and it is estimated that somewhat more than one-third of the increase resulted from higher volume.

Other income from a variety of operating and nonoperating sources was 42% more in 1977 than 1976. Details are provided in note 5 to the financial statements. From 1975 to 1976, other income increased 57%, principally due to a small, partial recovery (\$6.2 million) in 1976 compared with a write-off (\$28.9 million) in 1975 of Utah's share of losses associated with an expropriation; interest earned on a higher average level of short-term investments; and a nonrecurring gain (\$20.7 million) on the sale of investment in AEG-Telefunken.

Operating costs are summarized in the table at the right. Comparative details of operating costs for 1977 and 1976 are in the statement of earnings on page 32. Continuing cost control, combined with higher sales, resulted in improved 1977 operating margin dollars and maintenance of operating margin as a percentage of sales at 9.7%, the same as the strong rate achieved in 1976, which was up from 8.4% in 1975.

Interest and other financial charges were 14% more in 1977 than 1976, principally because of a somewhat higher level of foreign borrowings in connection with overseas operations. The 1976 interest charges were 6% lower than in 1975, primarily because of a lower average level of borrowings.

Provision for income taxes increased 16% in 1977 from 1976 because of higher taxable earnings after a 45% increase from 1975 for the same reason. Effective tax rates were 40.9% for 1977, 41.1% for 1976, and 39.2% for 1975.

**Supplemental information:** The information in the financial statements in this Report, in the opinion of management, substantially conforms with or exceeds the information required in the annual statements constituting part of the "10-K Report" submitted to the Securities and Exchange Commission, except for current replacement cost data. Certain supplemental information, considered non-substantive, is included in that report, however, and copies will be available without charge from: Investor Relations, General Electric Company, Fairfield, Connecticut 06431.

## Ten-year summary (a)

(Dollar amounts in millions; per-share amounts in dollars)

### Summary of operations

Sales of products and services to customers .....	
Materials, engineering and production costs .....	
Selling, general and administrative expenses .....	
Operating costs .....	
Operating margin .....	
Other income .....	
Interest and other financial charges .....	
Earnings before income taxes and minority interest .....	
Provision for income taxes .....	
Minority interest .....	
Net earnings .....	
Earnings per common share (b) .....	
Dividends declared per common share (c) .....	
Earnings as a percentage of sales .....	
Earned on average share owners' equity .....	

Dividends—General Electric .....	
Dividends—Utah International Inc. (d) .....	
Shares outstanding—average (in thousands) (e) .....	
Share owner accounts—average .....	
Market price range per share (c) (f) .....	
Price/earnings ratio range (c) .....	

Current assets .....	
Current liabilities .....	
Working capital .....	
Short-term borrowings .....	
Long-term borrowings .....	
Minority interest in equity of consolidated affiliates .....	
Share owners' equity .....	
Total capital invested .....	
Earned on average total capital invested .....	

Property, plant and equipment additions .....	
Depreciation, depletion and amortization .....	

Employees—average worldwide .....	
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- (a) Unless specifically noted, all years are adjusted to include Utah International Inc., which became a wholly-owned affiliate of General Electric on December 20, 1976, through the exchange of 41,002,034 shares of General Electric common stock for all of the outstanding shares of Utah.
- (b) Computed using outstanding shares as described in note (e).
- (c) For General Electric common stock as reported in the years shown.
- (d) Reflects transactions prior to merger date.

1977	1976	1975	1974	1973	1972	1971	1970	1969	1968
\$17,518.6	\$15,697.3	\$14,105.1	\$13,918.2	\$11,944.6	\$10,473.7	\$9,556.7	\$8,833.8	\$8,526.4	\$8,448.8
12,744.4	11,481.2	10,624.2	10,458.1	8,762.8	7,676.3	7,053.4	6,491.3	6,399.2	6,298.0
3,076.2	2,688.2	2,294.3	2,289.4	2,112.1	1,920.8	1,731.3	1,758.7	1,619.5	1,485.6
<u>15,820.6</u>	<u>14,169.4</u>	<u>12,918.5</u>	<u>12,747.5</u>	<u>10,874.9</u>	<u>9,597.1</u>	<u>8,784.7</u>	<u>8,250.0</u>	<u>8,018.7</u>	<u>7,783.6</u>
1,698.0	1,527.9	1,186.6	1,170.7	1,069.7	876.6	772.0	583.8	507.7	665.2
390.3	274.3	174.2	206.7	202.9	207.3	176.6	127.7	120.0	101.2
(199.5)	(174.7)	(186.8)	(196.5)	(142.8)	(120.8)	(102.1)	(105.5)	(83.8)	(75.0)
1,888.8	1,627.5	1,174.0	1,180.9	1,129.8	963.1	846.5	606.0	543.9	691.4
(773.1)	(668.6)	(459.8)	(457.4)	(456.5)	(385.5)	(332.8)	(237.2)	(240.8)	(319.1)
(27.5)	(28.3)	(25.7)	(18.2)	(11.9)	(5.0)	(4.2)	(5.8)	2.3	5.8
<u>\$ 1,088.2</u>	<u>\$ 930.6</u>	<u>\$ 688.5</u>	<u>\$ 705.3</u>	<u>\$ 661.4</u>	<u>\$ 572.6</u>	<u>\$ 509.5</u>	<u>\$ 363.0</u>	<u>\$ 305.4</u>	<u>\$ 378.1</u>
\$ 4.79	\$ 4.12	\$ 3.07	\$ 3.16	\$ 2.97	\$ 2.57	\$ 2.30	\$ 1.66	\$ 1.41	\$ 1.75
\$ 2.10	\$ 1.70	\$ 1.60	\$ 1.60	\$ 1.50	\$ 1.40	\$ 1.38	\$ 1.30	\$ 1.30	\$ 1.30
6.2%	5.9%	4.9%	5.1%	5.5%	5.5%	5.3%	4.1%	3.6%	4.5%
19.4%	18.9%	15.7%	17.8%	18.4%	17.5%	17.2%	13.4%	11.8%	15.3%
\$ 476.9	\$ 332.5	\$ 293.1	\$ 291.2	\$ 272.9	\$ 254.8	\$ 249.7	\$ 235.4	\$ 235.2	\$ 234.8
\$ —	\$ 28.3	\$ 33.1	\$ 23.9	\$ 14.0	\$ 12.8	\$ 11.4	\$ 8.9	\$ 7.6	\$ 6.5
227,154	225,791	224,262	222,921	222,631	222,503	221,591	218,938	217,048	216,332
553,000	566,000	582,000	566,000	543,000	542,000	529,000	535,000	525,000	534,000
57¼-47¾	59¼-46	52¾-32¾	65-30	75¾-55	73-58¼	66½-46½	47¼-30¾	49¾-37	50¼-40¾
12-10	14-11	17-10	19-9	24-17	25-20	26-18	26-17	32-24	25-20
\$ 7,865.2	\$ 6,685.0	\$ 5,750.4	\$ 5,334.4	\$ 4,597.4	\$ 4,056.8	\$3,700.0	\$3,383.1	\$3,362.6	\$3,395.5
5,417.0	4,604.9	4,163.0	4,032.4	3,588.2	2,920.8	2,893.8	2,689.4	2,398.2	2,130.0
<u>\$ 2,448.2</u>	<u>\$ 2,080.1</u>	<u>\$ 1,587.4</u>	<u>\$ 1,302.0</u>	<u>\$ 1,009.2</u>	<u>\$ 1,136.0</u>	<u>\$ 806.2</u>	<u>\$ 693.7</u>	<u>\$ 964.4</u>	<u>\$1,265.5</u>
\$ 772.1	\$ 611.1	\$ 667.2	\$ 655.9	\$ 675.6	\$ 453.3	\$ 581.7	\$ 670.2	\$ 351.5	\$ 288.0
1,284.3	1,322.3	1,239.5	1,402.9	1,166.2	1,191.2	1,016.2	691.3	813.6	884.4
131.4	119.0	104.6	86.4	62.4	53.4	50.4	45.0	42.3	40.3
5,942.9	5,252.9	4,617.0	4,172.2	3,774.3	3,420.2	3,105.4	2,819.1	2,610.8	2,556.4
<u>\$ 8,130.7</u>	<u>\$ 7,305.3</u>	<u>\$ 6,628.3</u>	<u>\$ 6,317.4</u>	<u>\$ 5,678.5</u>	<u>\$ 5,118.1</u>	<u>\$4,753.7</u>	<u>\$4,225.6</u>	<u>\$3,818.2</u>	<u>\$3,769.1</u>
15.8%	15.1%	12.5%	13.4%	13.7%	12.7%	12.3%	10.2%	8.8%	11.2%
\$ 822.5	\$ 740.4	\$ 588.2	\$ 812.9	\$ 734.6	\$ 500.8	\$ 710.8	\$ 685.3	\$ 567.3	\$ 542.9
522.1	486.2	470.5	415.0	371.9	343.7	289.5	348.1	365.0	312.2
384,000	380,000	380,000	409,000	392,000	373,000	366,000	398,000	412,000	402,000

e) Includes General Electric average shares outstanding plus, in 1976 and prior years, outstanding average shares previously reported by Utah multiplied by 1.3. Adjustments have been made for a two-for-one GE stock split in 1971 and the two-for-one and three-for-one Utah stock splits effected in the form of stock dividends in 1973 and 1969, respectively.

f) Represents high and low market prices as reported on New York Stock Exchange through January 23, 1976, and as reported on the Consolidated Tape thereafter.

	Dividends declared (Cents per share)		New York Stock Exchange market prices (c) (f) (High and low by quarter)			
	1977	1976	1977	1976		
First quarter	45¢	40¢	\$55¾	\$49	\$56¾	\$46
Second quarter	55	40	57¼	47¾	58¼	49¾
Third quarter	55	45	56½	50¾	59¼	52½
Fourth quarter	55	45	52¾	47¾	55¾	50¾

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General Electric Company  
Fairfield, Connecticut 06431



**New from General Electric** are the versatile food processor, at right, and new lighting products, above: 60-watt and 35-watt fluorescent lamps using 14%-20% less energy to produce nearly the same light output as standard lamps; and FlipFlash II, successor to GE-invented FlipFlash, with 50% more light distributed by prisms for better and more uniform pictures. Other GE products shown at top are, left to right: Light 'N Easy<sup>®</sup> iron, Toast 'N Broil Toast-R-Oven<sup>®</sup> toaster, micro cassette recorder, 40-channel CB radio and base station, Blaster<sup>®</sup> tape player, Super-Pro<sup>®</sup> hair dryer, electronic digital clock-radio, and battery-operated Home Sentry<sup>®</sup> smoke alarm.



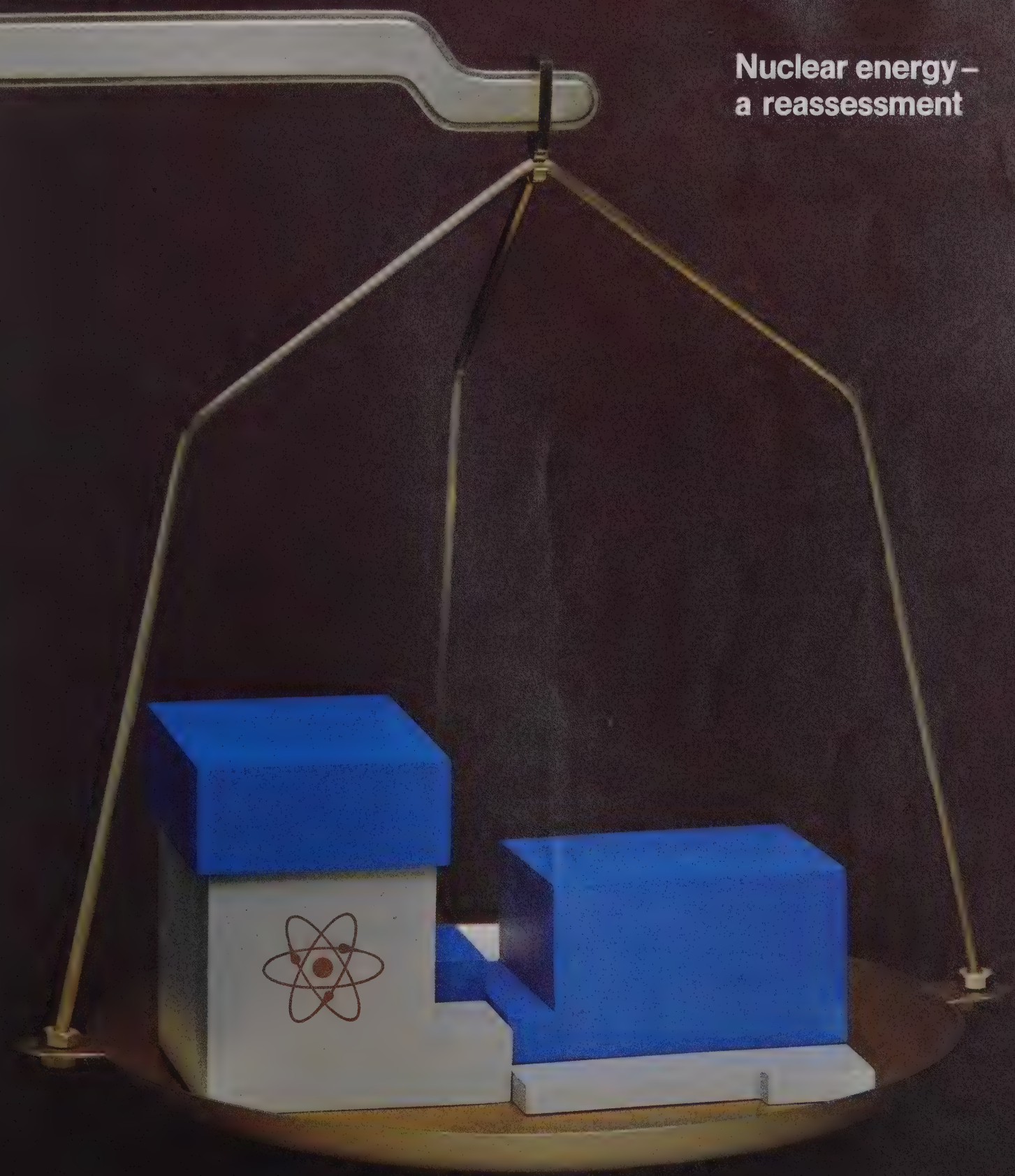
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GENERAL  ELECTRIC

INVESTOR

Summer 1977

**Nuclear energy –  
a reassessment**



# Reassessing nuclear energy: a statement by the Chairman

## Overview



**'It is time for the public discussion of nuclear energy to move beyond simplistic adversary perspectives and accept a rational approach that weighs trade-offs: risks versus benefits, problems as opposed to opportunities, and the effects of nuclear use compared with those of other forms of energy.'**

**Chairman Reginald H. Jones**

To General Electric share owners:

Among the letters and question cards you send us, nuclear energy continues to be one of the most active themes, as individual owners try to make up their minds about this hotly debated energy source. At last April's Statutory Meeting, several church-related groups joined in presenting for the share owners' vote a proposal calling for more information on nuclear power. Because of this interest, we are devoting this issue of the *Investor* exclusively to the subject.

What is called for, it would seem, is a reassessment of nuclear energy. We ask you, as responsible citizens, to join in that reassessment and make this an occasion to reach your own conclusions as to where you stand on the use of this technology in electric power generation and to decide what future course you advocate.

You will recognize that with a subject as complex as this there can be few absolute answers. Polarization of the nuclear debate has, far too long, generated more heat than light. In our view it is time for the public discussion of nuclear energy to move beyond simplistic adversary perspectives and accept a rational approach that weighs trade-offs: risks versus benefits, problems as opposed to opportunities, and the effects of nuclear power compared with those of other forms of energy. It is on the basis of such a balanced reassessment that valid decisions can be reached and sound actions taken.

To this end the *Investor* seeks to make three contributions:

- It outlines ten key issues in the nuclear debate and brings together in one place as much relevant data as our space permits. On each of these issues we have tried to summarize the arguments pro and con and to present the background information useful in understanding the issue. The ten basic questions covered include: Is nuclear energy really needed? What's its environmental impact? How safe is it? How do nuclear plants compare with other plants in reliable performance and cost-competitiveness? What can be done about the problems of weapons proliferation, fuel reprocessing and nuclear waste disposal? Do we need breeder reactors? And, finally, what are the present attitudes of the scientific community and the public toward nuclear power?
- A second purpose of these pages is to summarize the beliefs and opinions that your Company's managers and energy specialists hold concerning the central issues of the nuclear debate. Many General Electric people who have devoted their professional careers to nuclear power have formed deeply held convictions that are reflected in the conclusions and recommendations we present.
- Thirdly, this *Investor* reviews General Electric's role in nuclear development and summarizes how nuclear energy fits into the Company's broader program for helping to move the United States toward energy sufficiency.

In short, while we can't pretend to be non-partisan in the nuclear debate, we have made a careful effort in these pages to separate our reporting of relevant background information from the presentation of GE viewpoints.

**In preparing this report**, we who are your managers have ourselves done a great deal of rethinking and reassessing nuclear power. We have read some of the anti-nuclear literature that continues to pour

out, painting lurid pictures of the doomsday that awaits if mankind goes ahead with expanding the use of nuclear power. We have seen ourselves characterized as a conscienceless "nuclear establishment" or "atomic industrial complex" who, in our quest for profits, are willing to pass on to our children a legacy of radioactive disfigurement and death. Or, conversely, we are presented as so gullible a group that we lull ourselves into complacency by selecting only the most optimistic assurances and statistics about nuclear plant safety and reliability, blithely ignoring the grim realities.

Let me be explicit on where we really do stand on nuclear power.

We are not unmindful of the risks and problems. These have been topmost in the minds of GE managers since the day the Company began considering the development of a nuclear power business. For General Electric, nuclear power is only one element in a much broader span of operations. We couldn't afford to have the whole of our worldwide business threatened by catastrophic events in this one small part. Thus, public safety and the manageability of risks have been basic to our approach from the first. Over the years there have been mistakes and flaws in nuclear operations, as in any developing technology, but we think the record bears out the validity of our approach: these errors, human and mechanical, have invariably been contained by the multiple safeguards built into nuclear systems; no member of the public has been injured by a radioactive release from any nuclear plant.

**Today our support for nuclear power** stems from our concern for the energy future.

For years now your managers have sought to direct greater public attention to the energy problems that face the nation. We have urged energy conservation — and have practiced it rigorously in GE operations. We have recommended intensive development of such energy sources as solar power, geothermal and fusion—and General Electric scientists are working to advance these technologies. But we have also pointed out repeatedly that, on the basis of realistic energy demand/supply projections covering the remainder of this century, the U.S. cannot afford to rely solely on conservation, on the hopes aroused by unproved technologies and on continued increases in energy imports.

The country's evolving energy problems are, in our view, too serious to forgo or delay the use of any well-established energy technology. Rather, we see it as essential that the U.S. progress toward a *balanced* energy program that utilizes *all* of its energy supply options, including nuclear power. Only by that sort of intensive drive can the U.S. assure itself of the energy it will need for a growing work force and for a society in which today's poor and disadvantaged can fulfill their aspirations.

Our position is that, along with emphasizing conservation and new technologies and continued exploration for new oil and gas supplies, the United States must accelerate the use of its two most abundant energy sources—coal and uranium.

Obviously, in taking this position, we have satisfied ourselves that, in terms of trade-offs, the balance clearly favors increased use of nuclear power. We see the benefits accruing from nuclear

development vastly outweighing the risks its use entails. In terms of environmental compatibility, nuclear generation holds distinct advantages in that it involves no combustion and thus none of the problems that result from the by-products of combustion. As to conservation of scarce resources, nuclear plants make use of a fuel that has little other practical use, preserving the world's dwindling petroleum reserves for transportation, chemicals and other critical uses where oil and gas have distinct advantages. And we submit that the problems associated with nuclear power do not nearly rank in importance with the opportunity that the nuclear option presents to lessen the present costly dependence on, and dangerous vulnerability to, the oil-rich nations of the world.

**In summary**, we regard nuclear energy as one part, but a critically important part, of the balanced energy program that the U.S. and other countries of the world will need in meeting the energy demands of the future. The problems that will arise from *not* going ahead with nuclear power generation will, in our view, have much more serious impact than those that will result from nuclear expansion. Our reassessment leads us to continued support for a strong national commitment to nuclear energy, with concurrent emphasis on a balanced safeguards system that protects the public while allowing the nation's needed nuclear program to go forward on a predictable basis.

This *Investor* concludes with a note on how share owners can request more information on any of the matters presented in these pages. I would add that if, in working toward your own conclusions on nuclear energy, you wish to discuss, comment on, or argue about any aspect of our presentation, please write to us. I can assure you that your viewpoints will receive the most careful consideration.



Chairman of the Board  
and Chief Executive Officer  
August 10, 1977

### 1. Does the U.S. really need nuclear energy?

Nuclear opponents claim that by conserving energy, accelerating other technologies—particularly solar—and relying on coal to fill energy supply/demand gaps, the U.S. can avoid the expansion of nuclear generation altogether. Similarly it is claimed that the U.S. can afford to impose a moratorium on further nuclear plants until the concerns of nuclear opponents are resolved.

Nuclear proponents claim that expansion of nuclear power is essential to meet the projected growth in energy demand and that further delays will result in power shortages, blackouts and economic dislocations.

#### Background Information

In 1976 the United States consumed some 74 quads of energy. A quad is equal to one quadrillion BTUs of energy and is equivalent to 180 million barrels of oil, 44 million tons of coal or 2,400 tons of uranium ( $U_3O_8$ ). A single quad of energy would run a U.S. city of one million for three years.

About 75% of this energy came from oil and natural gas. The other 25% came from coal, hydropower and nuclear fuel.

Of the oil consumed in the U.S. in 1976, some 42% was imported, at a cost of about \$35 billion. In 1972, before the Arab oil embargo, the U.S. imported 29% of its oil, costing some \$5 billion.

About 30% of the energy used by the U.S. in 1976 was converted to electricity. The fuels used were: oil (16%), natural gas (15%), coal (46%), hydropower (14%), and uranium (9%).

In 1976 the U.S., with 6% of the world's population, accounted for 31% of the world's energy consumption. Nuclear opponents argue that the difference in these percentages includes a great amount of energy waste and that the U.S. can, with more rigorous conservation, meet its energy needs without nuclear power. Nuclear proponents point out that the high percentage for U.S. energy consumption is largely determined by its high rate of production, accounting for 25% of the Gross World Product.

Historically, U.S. energy consumption has

increased at a rate of about 3% a year. President Carter, making conservation the keystone of his energy plan, has set a goal of 2% annual growth in energy consumption by 1985. To this end, he has proposed a variety of tax measures designed to conserve energy and avoid energy waste.

The Carter administration has also put a high priority on greatly increased use of coal for power generation, targeting annual production of more than 1 billion tons by 1985. This compares with annual production of some 650 million tons at present.

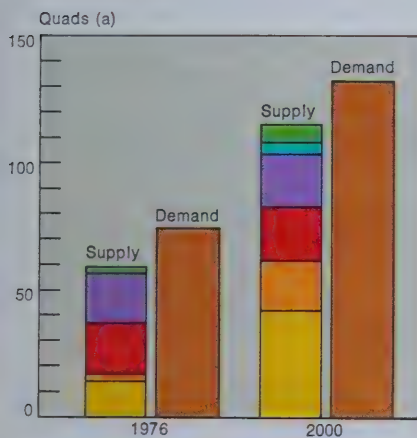
**Long-term projections** of energy requirements have been made in a number of studies, with total energy supply/demand forecasts influenced by such variables as size of the work force, availability and costs of competing energy sources, national programs of upward mobility for the disadvantaged, objectives for pollution control, and the standards of living that people are willing to accept.

A 1976 projection by the U.S. Electric Power Research Institute, for example, is based on the needs of the U.S. work force in the year 2000. Citing the Bureau of Labor Statistics prediction of a civilian work force of 113 million at the turn of the century, compared with 85 million in 1976, the study estimates that at historic growth rates the annual energy demand in 2000 will be 170 quads. Conservation is projected to help lower this total to 150 quads, double the U.S. energy consumption in 1976.

Three energy "scenarios" for the year 2000 have been developed by the U.S. Energy Research and Development Administration (ERDA). In one, vigorous conservation holds energy consumption at 117 quads. The second, based on high oil prices, projects the need for 129 quads. And the third, assuming that oil price increases will be moderate, foresees a demand of 139 quads.

On the supply side, ERDA's projections range from just over 113 quads to more than 119 quads. Of these totals, ERDA foresees coal providing 44 quads and nuclear 19. By

## Energy supply and demand 1976-2000



(a) One quad equals 180 million barrels of oil, 44 million tons of coal or 2,400 tons of uranium ( $U_3O_8$ ).

Other  
Solar  
Domestic oil  
Gas  
Nuclear  
Coal

Supply and demand estimates for the year 2000 are based on GE projections.

**In 1976, U.S. energy demand exceeded its supply by 15 quads—a shortfall that was met by imported oil. GE projections indicate that in the year 2000, even with the best conservation efforts and accelerated use of coal and nuclear energy, the shortfall to be made up by imported oil could be as much as 17 quads.**

comparison, nuclear generation accounted for 2.1 quads in 1976.

On the other hand, British Friends of the Earth representative Amory Lovins, in the publication *Foreign Affairs* for October 1976, outlines a scenario for the next 50 years in which energy consumption drops by half and centralized high technology such as nuclear power is eliminated, replaced by decentralized generation and conservation.

### Development of other energy sources

—sources other than those in general use today—could also change future energy supply projections. Those most frequently mentioned include:

- Solar power. Attempts to tap the inexhaustible energy in sunlight take many forms, including: solar heating and cooling of buildings; photovoltaic cells that convert sunlight directly into electricity; thermal “power towers” that produce steam for turbines by using huge banks of mirrors to focus the sun’s heat on tanks of liquid; and the variations in seawater temperatures that can be put to work in driving turbine-generators. Economical solar systems for heating hold promise in certain areas in the relatively near future. Solar systems for generating electricity are also under intensive development, particularly in government-sponsored projects, but as yet none is cost-competitive with conventional electrical generation.
- Geothermal. This technology seeks to utilize the vast reserves of heat beneath the earth’s crust. At present, however, it is economical to utilize only those few geyser areas where steam that is relatively free of corrosive material rises to the surface.
- Nuclear fusion. Development of this technology aims at harnessing the force that sustains the energy of the sun. Laboratory experiments have yet to prove the feasibility of attaining sustained controlled fusion. Assuming fusion is demonstrated to be feasible, a long period of development will be required.
- Other energy technologies under early

stages of development include the economical application of tidal power, windmill generators, biomass—the conversion of organic material such as agricultural and forestry wastes—and so-called “soft” technology involving local generation rather than generation at large central stations.

### A summation of energy prospects is

included in the Energy Program Fact Sheet prepared by the White House Energy Staff:

“Even with vigorous conservation, America’s demand for energy will continue to grow for the next decade. Although the United States will eventually make extensive use of solar and other nonconventional sources, it will have to rely, for at least the next two decades, on the conventional sources now at hand: oil, natural gas, coal, nuclear power and hydroelectric power.”

Analyses such as these underlie the Energy Staff’s call for the building of 300 additional nuclear plants by the year 2000.

### GE Viewpoint

While they differ somewhat with the ERDA data, GE’s projections of future supply and demand confirm the need for a substantial increase in the use of both coal and nuclear energy by the year 2000. Walter D. Dance, Vice Chairman and Executive Officer, whose responsibilities include GE’s power generation and power delivery operations, makes these observations:

“GE studies lead us to conclude that U.S. energy demand in the year 2000 will range from about 120 quads to 145, with a mid-point of 132 quads. We find no realistic basis for believing that significantly lower demand levels can be achieved without major economic disruption.

“General Electric fully supports the Administration’s decisions to give high priority to energy conservation. GE has conducted an increasingly vigorous conservation program since 1974. Our conclusion is that substantial savings can be made. However, these are largely one-time effects. Thereafter, additional savings come very hard and are relatively small. Never-

theless, in our energy demand projections we have deliberately made optimistic assumptions about the success of U.S. conservation programs.

"Similarly, on the supply side we have made optimistic assumptions about the prospects for increasing coal supplies, maintaining domestic oil and natural gas production, and the contribution to be obtained from solar power and other new energy sources. For example, our projections include a 5-quad contribution from solar energy in all its forms—a tall order, considering that we are starting from essentially zero.

"GE's most favorable projections for domestic energy supply, excluding nuclear, come to about 95 quads in the year 2000.

"Our inescapable conclusion is that without a substantial nuclear program, oil imports will rise sharply to a level which we believe to be unacceptable as a matter of national policy.

"GE has long advocated a multi-pronged approach to energy problems, with major

reliance on coal and uranium and with vigorous development of other domestic energy sources and new energy technologies.

"We recognize there is a range of uncertainty on what future demand will be. From the perspective of a national energy program, a fundamental issue is whether it is better to plan energy supply capacity for the upper or lower end of the demand uncertainty range. In our view, the risks of planning on the low side are far greater than the costs of planning on the higher side. If the U.S. errs on the high side, it will be easy enough to let energy demand catch up in subsequent years. The price to be paid is primarily the interest costs on capital which has been committed in advance of need. On the other hand, if the U.S. plans on the low side and is unable to meet the actual energy demand, the problems are far more serious. In view of the very long lead times required to develop new energy supplies, the nation will face dislocations, such as blackouts and unemployment, which cannot be remedied for many years."

## 2. What is nuclear energy's impact on the environment?



**Radiation (millirem/year):**

35  
from cosmic rays  
5  
from coast-to-coast jet flight  
5  
from air  
1  
from color television  
34  
from building materials  
25  
from food  
11  
from ground  
0.01  
from living within 50-mile radius of a nuclear power plant

**So little radiation escapes from the typical U.S. nuclear plant that it adds less than one percent to that received from sources associated with everyday life.**

There are two main ways that the day-to-day operations of nuclear plants affect the environment: through emissions of low-level radiation and the heating of water used in cooling nuclear plants' condensers. Nuclear opponents charge that the radioactive effluents constitute a danger to health by greatly increasing the incidence of cancer, and that thermal discharges are a threat to marine life. Proponents of nuclear power believe these charges are greatly exaggerated and that, in fact, nuclear plants pose less danger to health than coal or oil plants.

### Background Information

Electrical generation, regardless of the fuel source used or those being developed, results in some environmental impact.

The Union of Concerned Scientists believes that the commercial nuclear power plant program planned for the next 25 years in the United States represents a serious threat to the health and safety of the American people.

Many other scientists, however, believe that nuclear generation has environmental advantages in that it does not involve combustion, thus avoiding the emission by-products which accompany fossil combustion.

Day-to-day operations of a nuclear facility, however, involve two primary emis-

sion by-products: low-level radiation and thermal discharge.

Radiation surrounds us constantly. This background radiation is measured in millirems, and each year everyone is exposed to 100-150 millirems. At higher elevations, where exposure to cosmic rays is greater, the amount of radiation is correspondingly higher. U.S. government limits on radioactive emissions from nuclear power plants are based on recommendations of the International Commission for Radiological Protection.

Thermal discharge refers to unused heat produced in the generation process that must be dispersed to the environment. While fossil-fueled plants have both cooling water and smoke stacks to disperse this unused heat, nuclear plants disperse essentially all their reject heat in their cooling water.

Individual states and the U.S. Environmental Protection Agency limit the increase in water temperature allowed as the result of operating any power plant—usually less than a 5°F. rise in water temperatures adjacent to the plant. Larger plants being completed today also are required to install some form of closed-cycle cooling system—cooling towers or ponds—that greatly reduces or eliminates the impact of their thermal discharges.

In addition, beneficial uses of thermal discharges are being researched. Applications include heating greenhouses, providing frost protection for crops, heating homes and buildings, and accelerating growth of certain types of fish and shellfish.

### GE Viewpoint

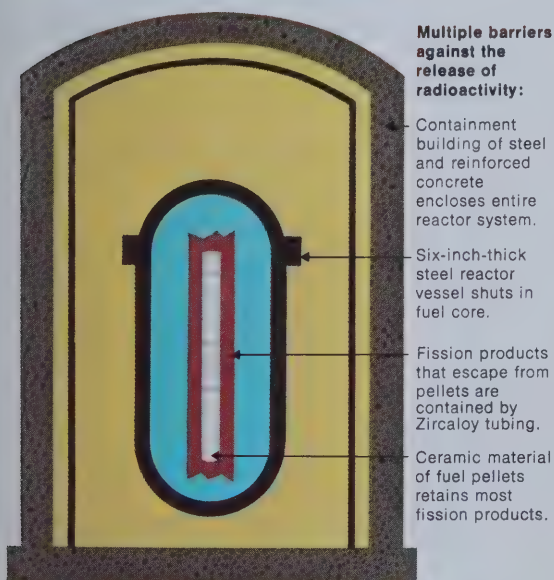
Nuclear power systems are designed to have minimal adverse impact on the environment. The technology has advanced to

the point where nuclear plants have the least impact of any large-scale system.

Today's reactor systems are designed to keep routine radioactive emission levels well below the conservative limits set by state and federal agencies.

Use of closed-cycle cooling systems where needed is expected to keep warm water discharges under control despite greater numbers of nuclear plants.

**Fuel assemblies in a nuclear reactor contain so dilute a percentage of fissionable material that a nuclear explosion is impossible. Nuclear safety is also enhanced by a series of barriers that constitute in-depth protection against release of radioactive material.**



## 3. How safe is nuclear energy?

Nuclear critics say that a nuclear plant accident could kill thousands of people, damage billions of dollars' worth of property and inflict untold numbers of injuries and genetic mutations. They also question the methodology used in the U.S. government's Reactor Safety Study (summarized on page 8) and claim that because the Study overlooks or underestimates a number of factors its findings are too optimistic.

Pro-nuclear spokesmen emphasize that a large-scale nuclear accident is among the most unlikely of imaginable events and that the safeguards built into nuclear plants have prevented, and will prevent, any such incident from occurring. Of the Reactor Safety Study they contend that it remains the most comprehensive examination of nuclear plant safety yet attempted.

### Background Information

Whether it's mine disasters, dam failures, gas explosions or oil fires and spills, risk is involved in every major form of power generation. Since the core of a reactor contains large amounts of radioactivity, the chief risk in nuclear power generation is the possible accidental release of harmful amounts of this radioactivity. The safety question hinges on whether the chance of such nuclear accidents can be reduced to an acceptably low level.

Nuclear critics cite instances that, in their view, *almost* resulted in a serious accident, including the partial meltdown of the Enrico Fermi fast breeder test reactor near Detroit in 1966 and the fire at TVA's Browns Ferry Nuclear Plant in Alabama that, in 1975, knocked out a number of safeguard systems. Nuclear proponents point out that in these instances the safeguards did in fact prevail and protect the public.

The past record is that commercial nuclear power plants have accumulated, on a worldwide basis, over 1,300 reactor years of operating experience without incurring

any accident that released a significant amount of radiation. Over all of this time, no member of the public has been injured by a radioactive release from these plants.

This safety record reflects what the industry terms "defense in depth":

- The fuel assemblies in nuclear power reactors contain so dilute a percentage of fissionable material—one-thirtieth of that in an atomic bomb—that a nuclear explosion is impossible.
- Nuclear reactor fuel is enclosed by a series of separate barriers that constitute in-depth protection against release of radioactive material: (1) the ceramic composition of the fuel itself, which retains most of the products of the fission process; (2) the cladding or tubes encasing the fuel pellets; (3) the reactor vessel, a thick steel tank holding all the fuel elements; and (4) the reactor containment building—an airtight shell of metal and reinforced concrete surrounding the reactor vessel and all equipment which is in direct contact with it.
- Defense-in-depth systems constantly monitor a plant's operation and automatically activate protective equipment in case of a failure—human, mechanical, or one caused by a natural disaster such as a tornado, earthquake or flood. These systems utilize the principle of redundancy; that is, for each vital function there are at least two separate instruments, detectors, controls, power supplies and the like, so that if one should fail or not operate properly, the backup unit will automatically take over.
- A final line of defense is provided by engineered systems designed to reduce the consequences of an accident, should one occur in spite of the other defensive measures. These systems isolate the containment building to prevent escape of any radioactive material.

A major engineered safety system is the emergency core cooling system (ECCS), designed to flood the entire reactor vessel in



**To guard against the remote possibility of a loss-of-coolant accident, GE boiling water reactor (BWR) systems include three safeguard systems to provide simultaneous spraying and flooding of the reactor core.**

the unlikely event there was a sudden loss of the reactor's normal cooling water while the plant was operating. The main purpose of the ECCS is to prevent the core from becoming hot enough to melt and subsequently breach the vessel and the containment structure.

If there should be a loss of normal coolant, the plant would automatically shut down, and the ECCS system would immediately flood the reactor from an alternate water supply. In this way, the nuclear fuel, which generates heat for a time even after the chain reaction has been stopped, is prevented from overheating. Stand-by diesel generators would pump the water, should off-site electrical power fail.

To these systems safeguards is added the in-depth design, construction and operating review by the Nuclear Regulatory Commission (NRC) which is specifically charged with assuring the safety of U.S. nuclear power plants.

What assurance does the nuclear power industry's past safety record provide for the future? To assess future probabilities, the U.S. government in 1972 sponsored a Reactor Safety Study by a team of over 60 experts headed by Professor Norman C. Rasmussen, of the Department of Nuclear Engineering at the Massachusetts Institute of Technology.

The methodology of the Rasmussen study was to analyze the reactor system and determine what failures or combinations of failures could lead to the release of radioactivity. Thousands of possible accident sequences were evaluated. The risks posed by these hypothesized nuclear plant sequences were calculated and compared with other types of man-made and natural risks.

Completed in 1975, the Reactor Safety Study ran to 14 volumes and over 3,500 pages. Its final pages include this summary:

"Nuclear accident risks are relatively low compared to other man-made and natural risks. All other accidents, including fires, explosions, toxic chemical releases, dam failures, earthquakes, hurricanes and tornadoes, that have been examined in this study are much more likely to occur and can have consequences comparable to or greater than nuclear accidents."

A draft version of the Reactor Safety Study received widespread peer and public review which resulted in revisions that were incorporated in the final report.

Recent NRC computer analyses lend

support to the Study's findings. Examination of possible reactor vessel failures and of the ECCS indicates that nuclear systems are as effective "as they are calculated to be and will probably be more effective" and that the failure probability "lies within the range of  $10^{-8}$  to  $10^{-6}$  (one chance in a hundred million to one chance in a million) that was predicted in the Rasmussen Reactor Safety Study."

On the other side of the debate, the Natural Resources Defense Council believes that nuclear safety and reliability questions are far from answered and that too many of the nation's energy eggs are in the nuclear basket, inhibiting development of promising and safer alternative sources.

### GE Viewpoint

"Nuclear plants are designed so that the results of an entire spectrum of failures or errors can be accommodated without endangering public safety." That is one of the points made by A. Philip Bray, General Manager of the Boiling Water Reactor Projects Department in the Nuclear Energy Systems Division, when he discusses General Electric's viewpoints on nuclear safety. He goes on to say:

"From the beginning of its involvement with nuclear energy, General Electric has felt a strong corporate responsibility for the safety of its nuclear plants. The Company would not participate unless it believed the safety risks were small.

"GE has invested heavily in facilities to provide testing of its nuclear components under simulated accident conditions.

"As in a number of high-technology field endeavors, there may be some aspects of the confirmatory testing of a new nuclear plant design concept that may not be completed at the time of the project start. However, such testing has always been satisfactorily completed and totally reviewed and approved by the governmental authority prior to the time that the plant is licensed for operation several years later.

"Through such testing, GE confirms the functional acceptability of the component or system, puts a dimension on its reliability potential, and establishes the safety margins engineered into the design.

"General Electric is continually broadening its BWR development and testing programs so as to assure that its nuclear systems meet the highest standards for safety, efficiency and reliability."

## 4. In terms of operating performance, how reliable are nuclear plants in comparison with plants fueled by coal or oil?

**Performance of large fossil and nuclear units, 1965-1974**

	Unit availability	Capacity factor
Fossil (600 megawatts and larger)	73.3%	58.1%
Nuclear (600 megawatts and larger)	66.3	54.9

Nuclear opponents describe nuclear plants as unreliable, plagued by myriad breakdowns. Proponents point to averages for nuclear plant availability and capacity that compare favorably with coal and oil plants.

### Background Information

Utilities use two methods in measuring the performance of an electric generating unit:

- Availability—the proportion of time during a given period that the unit was capable of producing electricity; and
- Capacity factor—the electricity actually produced during a period of time compared to the amount that could have been generated had the unit run constantly at full capacity.

Precise comparisons of relative performance are difficult for several reasons, including the much higher number and greater variations in plant size for coal- and oil-fired plants. Thus, there is disagreement about the performance record, and the Council on Economic Priorities cites “disappointing” statistics for nuclear reliability.

On the other hand, a number of comparative studies show nuclear plants performing about as reliably as coal and oil plants:

- A study of power plants over the ten-year period 1965-1974 by the Edison Electric Institute, using NRC data for large nuclear

plants, found that “the overall performance of nuclear plants does not differ significantly from that of their large fossil counterparts.” Data are shown at left.

- A study of operating availability over the period 1965-1975, made by Arthur D. Little, Inc., concluded that “nuclear plants are fully competitive with large fossil-fired units” and added: “We anticipate improvements in operating availability for both nuclear and fossil plants as a result of evolutionary design changes, and we project that both types of plants will remain closely competitive in this respect.”

### GE Viewpoint

“Nuclear plant performance is currently at about the same level as that of other forms of electric generation, and we expect to see the performance of nuclear systems improve in the years ahead.”

This is the view of Dr. Roy H. Beaton, Vice President and General Manager, Nuclear Energy Systems Division. Of GE’s BWR systems, he states:

“The engineering and development work that GE is doing in support of the nuclear projects in the backlog, coupled with greater plant standardization, can be expected to improve significantly both capacity factor and availability.”

## 5. Is nuclear generation competitive in costs with oil or coal plants?

Escalating plant construction costs, poor performance and rising uranium prices are among the factors that make nuclear plants uneconomical, say nuclear critics. Proponents cite studies showing that, on the average, nuclear-produced electricity costs less than that from coal or oil plants.

### Background Information

Relative costs of electric power generation vary in different areas of the United States. “In the Northeast and the Southeast, light water reactors are the most economical plants to operate,” ERDA official Robert D. Thorne testified at a Senate hearing on March 24, 1977. “In the Midwest, it’s a toss-up. In the Far West, coal is the most attractive option to energy producers.”

Press reports quote Albert J. Kleban,

Chairman of the Connecticut Public Utilities Control Authority, as saying, “I’d hate to think where we’d be with the cost of electricity in the state of Connecticut without nuclear power.” He added: “The economics of nuclear power are overwhelming.”

A June 1977 survey by Arthur D. Little, Inc., states: “In all cases shown, the nuclear advantage ranges from about 1 mill/kwh—when compared to use of low-sulfur western coal—to 5.5-6.5 mills/kwh—when compared to use of high-sulfur eastern coal.”

In 1976, nuclear energy produced, on the average in the U.S., a kilowatt-hour of electricity for 1.5 cents, according to a survey of utilities conducted by the Atomic Industrial Forum. This was 18% less than the cost of coal generation (1.8 cents) and 58% less than oil generation (3.5 cents).

**Questions of "net energy"** have been raised: does the energy required to build and fuel a nuclear plant exceed the energy it will produce over its lifetime? A number of analyses confirm that nuclear plants pay back their initial energy investment in a relatively few months. Present coal and nuclear plants are about equal on a net energy basis.

**Projections of future costs** must take into account many variables affecting both nuclear and fossil-fueled plants, including further escalation in plant costs, fuel costs and costs of environmental protection. Safeguards against proliferation could impose extra costs on nuclear energy, while costs of strengthening the economic infrastructure to handle major increases in coal mining and transportation could affect coal-fired plants. The recent study by the Mitre Corporation for the Ford Foundation states:

"Despite these large uncertainties, our analysis leads us to the conclusion that nuclear power will on the average probably be somewhat less costly than coal-generated power in the United States."

The Council on Economic Priorities has a different point of view, contending that a disappointing reliability record for nuclear power plants and an equally negative outlook for future performance have continued

to erode nuclear cost competitiveness.

### GE Viewpoint

"While in many locations the per-kilowatt-hour cost of nuclear generation is presently less than that of both coal and oil generation, we believe that this cost advantage will be lost in many areas unless the regulatory cycle is simplified and shortened so as to speed up plant construction."

Dr. Thomas H. Lee, Manager—Group Strategic Planning Operation, the Power Generation Group, states this view, adding:

"Escalation of costs for nuclear generating plants reflects such inflationary factors as higher plant construction costs and higher interest rates. But our analysis shows that the greatest increases in recent years have come from the impact of regulatory requirements. Disputes over plant siting, reactor safety and environmental protection, complicated by overlapping jurisdiction of federal, state and local agencies, have lengthened the licensing and construction cycle to ten years or more, compared with five or six years in the early '60s. As a result, money costs—the interest on capital tied up during construction—now exceed the hardware costs of the reactors and turbine-generators."

## 6. What can be done to guard against the spread, or proliferation, of nuclear weapons capability?

### World survey of non-U.S. nuclear power reactors

<b>Operating</b> 19 Countries 138 Reactors 47,655 MWe	Argentina Belgium Bulgaria Canada Czech. France Finland E. Germany W. Germany India	Italy Japan Netherlands Pakistan Spain Sweden Switzerland UK USSR
<b>Under Construction</b> 7 Add. Countries 118 Reactors 90,943 MWe	Austria Brazil Taiwan Hungary	S. Korea Mexico Yugoslavia
<b>Ordered</b> 5 Add. Countries 50 Reactors 42,135 MWe	Iran Luxembourg Philippines Rumania	S. Africa
<b>Planned</b> 14 Add. Countries 175 Reactors 182,058 MWe	Cuba Denmark Egypt Hong Kong Indonesia Ireland Israel	Poland Portugal Kuwait Thailand Turkey Libya N. Caledonia

Expansion of commercial nuclear power generation, according to nuclear opponents, greatly increases the possibility that atomic bombs will be developed by other nations or by terrorist groups. Nuclear proponents contend that the commercial nuclear cycle is an ineffective way to develop bomb capability and has not been used by any of the six present nuclear-weapons nations. The U.S. can best control nuclear weapon proliferation, they argue, through technical leadership that can make access to superior energy technology contingent on forgoing atomic weapons.

### Background Information

Concern about the spread of nuclear weapons has been basic to U.S. policies since the end of World War II.

In 1946 the U.S. government proposed international control of nuclear energy, and in 1954 it sponsored the "Atoms for Peace" program.

Thereafter, the U.S. took the lead in establishing an international political frame-

work involving the Nonproliferation Treaty (NPT) and the International Atomic Energy Agency (IAEA). Under the NPT, nuclear "have" nations offered "have nots" a bargain: access to peaceful nuclear energy in exchange for forgoing atomic weapons. The IAEA administers a program of safeguards designed to deter proliferation by warning that nuclear materials have been diverted from peaceful uses. A total of 111 countries are NPT signatories; 39 countries are not.

Three of the six nuclear-weapons states—France, India and the People's Republic of China—are not parties to the NPT, but France has announced adherence to its principles.

None of today's six atomic-weapons nations obtained its explosive materials from commercial nuclear power facilities. Similarly, a nation bent on acquiring a nuclear weapon would be likely to regard today's nuclear reactors as a costly, slow and technically cumbersome way to obtain a nuclear weapon. The more practical course is to utilize facilities built specifically for this

purpose. Consequently, nuclear power plants themselves are not generally considered central to the proliferation problem.

Two other aspects of the nuclear fuel cycle—fuel enrichment and reprocessing of spent fuels—figure more prominently. Enrichment facilities could be employed to produce nuclear explosive materials. Reprocessing of spent fuels from a nuclear plant separates plutonium, which is both a nuclear fuel and a material from which a nuclear explosive can be fabricated.

U.S. policy has for years prohibited the export of enrichment and reprocessing technology. The U.S. government has provided enrichment services—and continues to operate this country's only enrichment facilities. About 90% of the western world's reactor fuel has been enriched in U.S. government plants. Today, however, four other nations have developed their own enrichment facilities, and an additional seven nations or groups of nations are planning them.

In the U.S. today, reprocessing capabilities have been developed but at present no commercial reprocessing services are available. Outside the U.S., reprocessing facilities have been developed in six nations, and at least eight others have laboratory or pilot-scale reprocessing facilities.

Because of concerns about the proliferation risks of wide-scale civilian use of plutonium, President Carter has announced an indefinite deferral of U.S. commercial reprocessing and recycling of plutonium and has called for a halt to the country's major breeder reactor development project.

### GE Viewpoint

"The U.S. can do more to control proliferation by reinvigorating its leadership in nuclear technology than by entering a new period of virtual isolation. The primary interest of most nations today, particularly those with little or no fossil fuel reserves, is not in atomic weapons but in nuclear energy and the relief it can bring from energy imports."

These points are made by George J. Stathakis, Vice President and General Manager, Nuclear Energy Programs Division, who adds:

"While we fully support the President's objectives on nonproliferation, we are very concerned that the methods being employed will not help, and may hinder, our effectiveness in achieving those objectives.

"Since an international capability for supplying nuclear power already exists, any action by the United States to limit its

use or influence its manner of deployment in the cause of nonproliferation can only be successful in cooperation with the other supplier nations.

"Today U.S. participation in the international nuclear market is sharply diminishing. This is not because our products lack competitiveness. Rather, we are facing a crisis of confidence. Customer nations that have committed themselves to U.S. nuclear technology now see their energy future confused because of changing U.S. nuclear policies, which appear to many of these countries as unfair, arbitrary and inconsistent with past practice. This uncertainty tends to divert customer nations to national suppliers who represent stronger supply assurances.

"With numerous other nations now supplying facilities covering the whole nuclear cycle, the United States can no longer singlehandedly set the course for nuclear development.

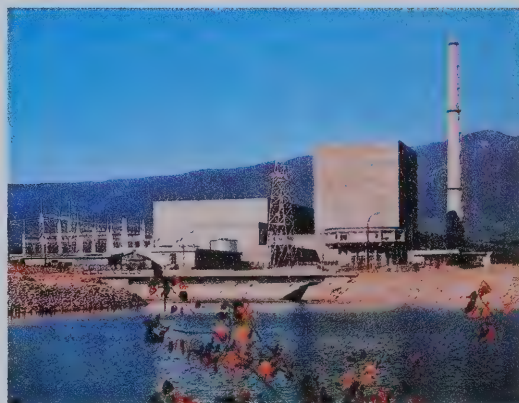
"Actions taken in the name of nonproliferation that have the effect of reducing our nuclear technological leadership are self-defeating. They only weaken this country's position in influencing nonproliferation arrangements at the international level. In our view, the U.S. government could contribute to international control of proliferation by taking constructive steps that include:

- Providing guaranteed enrichment, reprocessing and other fuel-cycle services to user nations on a fair and nondiscriminatory basis;
- Cooperating with other nations in placing the proliferation-prone areas of the commercial fuel cycle under internationally supported safeguards;
- Continuing to encourage other nations to sign the NPT and strengthen the IAEA; and
- Following a consistent nuclear export program."

## The atom abroad: what other countries are doing



**Today 45 countries outside the U.S. have chosen to use nuclear power as an energy source. Operable non-U.S. nuclear capability now exceeds that within the U.S. Switzerland, for example, is one of the world's leaders with 18% of its electricity produced with nuclear power. Of seven Swiss nuclear plants operating or on order, four are GE BWR units.**



**Spain's nuclear commitment includes five GE-equipped units, with one plant already in operation and 4 other BWRs on order. Shown: the country's first boiling water reactor plant—Santa Maria de Garoña. GE's Spanish affiliate, General Eléctrica Española, is participating in the supply of equipment for Spanish nuclear facilities.**

(Continued on page 12)

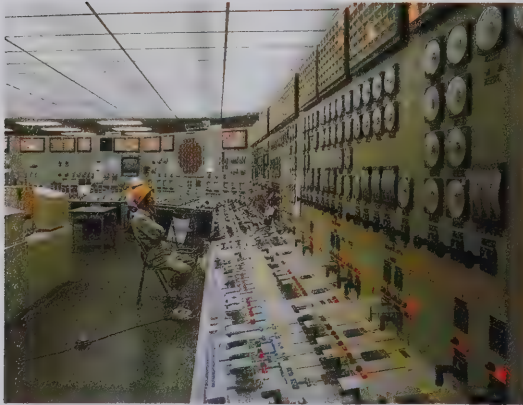
## For Japan, nuclear energy is a 'must.'

"For us here in Japan, it is not a question of favoring nuclear energy over other energy forms. We *must* develop nuclear!"

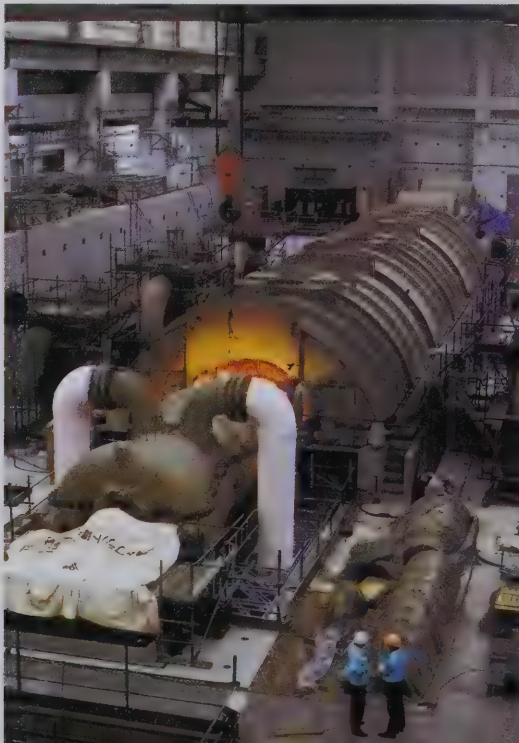
The speaker is Ikuo Kokubu, Deputy Secretary General of the Japan Atomic Industrial Forum, Inc. The reason for this emphatic view of nuclear energy: Japan presently imports 90% of its primary energy. Hydropower is already fully developed, and there is little domestic coal.

If Japan is to avoid continued dependence on energy imports, according to Michitaro Akiyama, Director and Executive Officer of the Japan Atomic Power Company, "there is no course left for Japan but to develop nuclear energy capabilities."

Fifteen GE-type boiling water reactors are operating or on order in Japan. Five are GE-built, with 10 others being supplied by GE licensees.



Shown: scenes of Japan Atomic Power Company's Tokai 2, an 1100-megawatt BWR nuclear power plant from General Electric. The plant is now 90% complete and has started pre-operational testing.



## 7. Can reprocessing of nuclear fuel and disposal of high-level waste be accomplished safely?

Nuclear power plants are seen by nuclear critics as burdening future generations with wastes that will remain dangerously radioactive for thousands of years. Proponents, pointing to the small volume of these wastes and to the fairly rapid decay of most of the radiation, believe they can be stored so that they will not pose any serious future danger.

### Background Information

While reprocessing is available in six nations abroad, there are at present no commercial reprocessing facilities operating in the U.S. For several years the U.S. commercial nuclear industry has been hampered by technical difficulties and the lack of clear government policies on reprocessing. Now the Carter administration, concerned over current world safeguard procedures, has deferred U.S. reprocessing, in the belief that this will help prevent the possible diversion of reclaimed plutonium for weapons purposes.

About one-fourth to one-third of the fuel in a nuclear reactor each year is considered exhausted and is replaced. When the spent fuel assemblies are removed from the reactor, they are temporarily placed in water-filled storage pools to allow the shorter-lived radioactivity and heat to subside.

These fuel elements still contain much valuable uranium that could be recycled into new fuel. As a first step, these radioactive used fuel elements could be transported in heavily shielded shipping containers to a reprocessing plant, where the reusable uranium would be separated from the fission products. Since the fission process turns some of the uranium into plutonium, the reprocessing plant would also separate this material for reuse as a fuel.

The reclaimed uranium and plutonium could then be shipped to fuel fabrication centers. The radioactive wastes, which include some unrecoverable plutonium and other long-lived radioactive materials, then would be turned over to the government for permanent disposal.

The handling and disposal of nuclear wastes have generated concern over the human impact of plutonium.

Typical of the charges made concerning plutonium is that it is "one of the most toxic substances known to man" and that the release of a quantity of plutonium into the environment would result in thousands of additional cancers.

Controversy over the integrity of long-term storage is based on the need to isolate future generations from wastes which will remain radioactive far into the future. The Energy Research and Development Administration has launched field studies to select sites for federal burial of wastes. Also under government review is surface storage of commercial wastes housed in air- or water-cooled canisters inside concrete on a federal reservation.

### GE Viewpoint

"We see both reprocessing and permanent waste disposal as essential to the long-term energy future. With reprocessing, commercial reactors would save 25 to 30% of the potential fuel supply compared to no reprocessing. The combination of reprocessing and the breeder reactor offers today's most technologically feasible path to a virtually infinite energy supply."

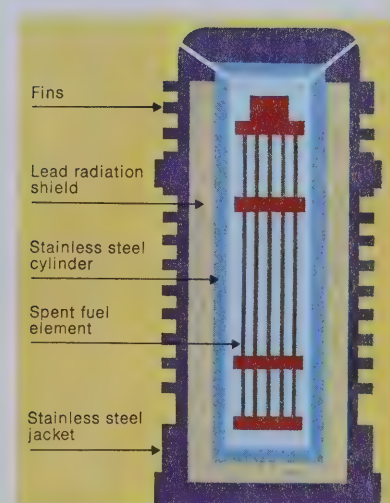
These are among GE viewpoints on reprocessing and handling of nuclear wastes, as summarized by Dr. Bertram Wolfe, General Manager—Fuel Recovery and Irradiation Products Department, Nuclear Energy Programs Division. He explains:

"In conjunction with its weapons program, the U.S. government has carried out nuclear reprocessing and waste storage programs for more than 25 years without detriment to the public. There have been errors, such as leakage that occurred in Hanford, Washington, storage tanks built during World War II, but none of these government programs has resulted in instances of radioactive exposure or of injury to any member of the public. Safeguards have also been consistently maintained against diversion of these materials for possible proliferation of atomic weapons.

"We see no reason why this record cannot be sustained, and improved upon, in the handling of spent fuel and wastes from commercial nuclear power plants.

"An American no-reprocessing policy may encourage nations that have committed themselves to U.S. nuclear facilities and fuel-cycle services to build their own reprocessing facilities—possibly without adequate safeguards.

"The claims made about the toxicity of plutonium are misleading. Plutonium is not highly toxic in a chemical sense. It is not a rapidly acting poison like potassium cyanide. Its principal radiation is not penetrating; a piece of writing paper can serve as



**Casks used in transporting spent nuclear fuel are the most carefully fabricated and tested shipping containers used by man. During more than 30 years of transporting spent nuclear fuel, no one has ever been injured by the radioactive nature of the cargo.**



**Nuclear wastes are low in volume. From one of today's large nuclear plants, wastes with low levels of radioactivity amount to about two railroad cars per year. After reprocessing and solidification, high-level wastes occupy about the space of two telephone booths. The comparable annual volume of wastes from a coal-fired plant: 12,000 railroad cars.**

an effective shield. But it is a radioactive substance and toxic if it is lodged in the body, so proper precautions must be taken to prevent exposure to it.

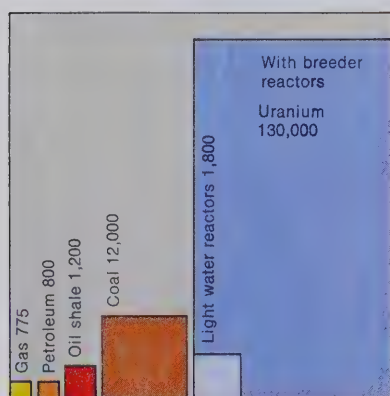
"Tons of plutonium have been handled in the U.S. weapons programs over a period of many years without any known instance of plutonium-induced cancer among employees or the public. We are confident that plutonium can also be handled safely in a program for the reprocessing and fabrication of reactor fuel. The United States can manage the handling of plutonium as it now routinely handles other toxic substances.

"Similarly, the disposal of radioactive wastes poses no insurmountable technical problems. Future generations of Americans will be put much more in jeopardy by the continued massive outflow of national wealth for energy imports, and by international unrest caused by energy shortages, than by the relatively small amounts of nuclear wastes that will need to be, and can be, shielded against human contact."

## 8. Does the U.S. need breeder reactors?

### Available energy from recoverable domestic energy resources

Available energy in quads ( $10^{15}$  BTU) shown graphically by source.



Source: A National Plan For Energy Research, Development & Demonstration, ERDA-48 (1975)

**With breeder reactors, the available energy from recoverable domestic uranium resources grows to 130,000 quads. Total U.S. energy consumption in 1976 was about 74 quads.**

Breeder reactors produce plutonium and thus increase the possibilities for weapons proliferation, nuclear opponents claim. Also, breeders are seen by critics as unnecessary because by the time this technology is fully developed, more desirable energy sources such as solar power will be available. Proponents cite the breeder's effect in vastly extending uranium resources and regard its continued development as insurance against the future depletion of uranium.

### Background Information

A breeder reactor is designed to produce both power and new fuel simultaneously. Fueled with uranium and plutonium, it produces or "breeds" more new fissionable material than it consumes. For this reason the breeder figures prominently in the future planning of the nuclear power industry. As shown in the chart at left, it is expected to have enormous effect in increasing the energy recoverable from uranium resources. In addition, breeder reactors could put to use the reserves of plutonium accumulated in the United States atomic weapons program as well as those resulting from the reprocessing of spent fuels from light water reactor power plants.

U.S. development of breeder reactors has been underway since the mid-1940s. Experimental breeder reactors have been operated since 1951. A major project today is the U.S. Clinch River Liquid Metal Fast Breeder Reactor Demonstration Project.

Apprehension about the breeder reactor exists in large part because a breeder produces plutonium, which might be diverted to the development of atomic weapons. It is also argued that the U.S. will not need the breeder because the country has ample reserves of uranium to see it through until

"renewable" energy technologies such as solar and fusion can be developed.

Outside the United States, nine nations are actively proceeding with the development of breeder reactors. Four of the nine—Japan, Great Britain, France and the U.S.S.R.—already have operating breeder reactors.

### GE Viewpoint

"Breeder reactor technology offers the promise of energy abundance without significant mining and environmental damage. Using uranium resources about 60 times more efficiently than present reactors, the breeder will transform low-grade uranium ores into low-cost sources of energy for literally centuries to come." This summarizes GE's position, as expressed by Dr. Robert B. Richards, General Manager—Fast Breeder Reactor Products Department in the Energy Systems and Technology Division. He adds:

"Our projections raise doubts whether 'renewable' energy technologies can be developed before uranium reserves, without the breeder, are exhausted. Also, the breeder can put to use the vast amounts of uranium now stored as by-products of the U.S. atomic weapons program.

"The benefits to be derived from pursuing breeder technology greatly outweigh, in our view, the risks cited in deferring U.S. breeder development. Dropping the breeder will reduce—not enhance—U.S. influence in shaping worldwide nuclear nonproliferation policies."

## 9. How does the scientific community regard nuclear energy?

**"Nuclear power is an essential power source for the immediate future."—the 69,000-member National Society of Professional Engineers**

**"Any energy policy should include the increased use of nuclear energy for electric power generation."—the Energy Committee of the 170,000-member Institute of Electrical and Electronics Engineers**

**"We see no reasonable alternative to an increased use of nuclear power to satisfy our energy needs."—group of 32 noted U.S. scientists, including 11 Nobel Laureates**

Nuclear opponents include scientists as well as engineers who have resigned from jobs in the nuclear industry. Nuclear proponents see these individuals as a small minority, greatly outnumbered by those in the scientific community who have taken pro-nuclear stands.

### Background Information

Technical societies and groups have taken public positions on both sides of the nuclear controversy. Prominent among the nuclear opponents is the Union of Concerned Scientists. Its original petition drive directed at members of the scientific community drew support from some 2,000 scientists and engineers. Its present larger list also includes many non-technical contributors.

Technical societies and groups taking pro-nuclear positions are large and numerous, as indicated at left.

### GE Viewpoint

For many years, General Electric has conducted ongoing scientific and engineering evaluations, independent from those done in GE nuclear operations, to appraise the technical and economic viability of nuclear power.

The Company concurs with the opinions of the overwhelming majority of the scientific community who regard nuclear energy as essential to meeting U.S. energy needs.

## 10. What are public attitudes toward nuclear energy?

### Highlights of Louis Harris poll on nuclear energy

**The U.S. public favors accelerated nuclear plant construction:  
61% in favor; 22% opposed.**

**Some 64% of the public feel there will be serious energy shortages 10 years from now.**

**70% of the residents of communities near nuclear plants support nuclear power.**

**72% of the public believe nuclear plants are worth the risk if tough government standards are met.**

Mass demonstrations against nuclear plants, and other anti-nuclear measures, tend to create the impression that most people are opposed to nuclear development. Surveys of public opinion cited by nuclear proponents suggest the opposite.

### Background Information

Nationwide public opinion surveys show that the majority of Americans favor the building of more nuclear power plants.

Results of a national opinion poll commissioned by EBASCO Services, Inc., and conducted by Louis Harris & Associates, Inc., in November 1976 are summarized at left.

Strong public support for nuclear energy was further confirmed by another survey conducted by ABC News and Harris, following President Carter's April 20, 1977 energy message. That survey found Americans favoring a speed-up in construction of nuclear plants by more than a 3-to-1 margin—68% in favor, 21% opposed.

A survey conducted in October 1976 by the Roper Organization showed that 70% of the public favored increased nuclear energy development. Nuclear power was supported by both males and females (74% and 66%), executives/professionals and blue-collar workers (80% and 67%), and college-educated and grade-school-educated (76% and 54%).

A Harris survey released in May 1977 indicated a major disagreement between the public and consumer activists on the importance of targeting nuclear energy for attack. Responses from the public showed 19% seeing nuclear power as an important target, with 61% of the activists taking this view.

During 1976, proposals to place limitations on further construction of nuclear power plants were placed on the ballot in seven states. Nearly 14 million Americans thus voted on the nuclear issue. More than 9 million voted against the proposals to restrict nuclear energy. The totals amounted to a 2-to-1 margin in favor of nuclear expansion.

### GE Viewpoint

Although nuclear power is favored by a significant majority of all Americans, this public acceptance is not yet adequately reflected in legislation or governmental policies.

Positive governmental support of the nuclear option, reflected in action programs that clear away present obstacles posed by the regulatory process and fuel-cycle problems, could reinvigorate nuclear technology and produce a new wave of nuclear expansion to meet the energy needs of the future.

# General Electric — a key participant in developing nuclear energy

## GE's Nuclear Role

A final series of questions raised by share owners concerns the scope of General Electric's participation in the nuclear power industry. Specific queries cover the entire cycle from uranium mining to nuclear waste disposal.

### Over 30 Years of Nuclear Experience

General Electric's nuclear energy operations primarily offer nuclear steam supply systems, nuclear fuel fabrication services and nuclear plant services for boiling water reactors (BWR).

Historically, General Electric's involvement began in the Company's Research Laboratory. There, in 1940, GE physicists served on one of two U.S. teams who succeeded in separating U-235 from natural uranium. Tests had proved this isotope to be capable of the energy-releasing process of fission and showed that neutrons which were liberated could keep the process going in a chain reaction, making possible the use of U-235 as a practical source of atomic energy.

In the early 1950s, the Company took the first steps toward developing a commercial nuclear business, by contracting to study electric power generation using nuclear

energy. And in 1956 the Company established its first commercial nuclear business organization—the Atomic Power Equipment Department.

As a result of its wide experience with a variety of reactor types, General Electric selected the boiling water reactor as its commercial offering for power generation. GE engineers chose the BWR because they believed that the greater simplicity of its design would facilitate the development of a more reliable, lower-cost power plant.

In 1957, the U.S. granted Power Reactor License Number One to General Electric's Vallecitos boiling water reactor—the nation's first privately owned nuclear generating facility. The plant generated 5000 kilowatts of power for the Pacific Gas and Electric Company until its retirement from service in 1963.

The Vallecitos facility served as a prototype for Dresden I, the world's first large-scale, privately financed nuclear power plant. Dresden I, which was ordered in 1955 and began commercial operation in 1960, delivers 200,000 kilowatts of electrical generating capacity to the Commonwealth Edison Company system.

To get the new industry moving in the

1957



1960



early 1960s, the Company for a time broadened its span of responsibilities. Recognizing that utility customers were hesitant to order nuclear plants because they were uncertain about what was then an infant technology, General Electric offered "turnkey" projects in which GE accepted on a firm-price basis the total responsibility for nuclear plant construction and start-up. GE built 13 turnkey nuclear units, completing the last of them in 1972.

While these turnkey projects incurred substantial losses as costs escalated, they did provide the opportunity to apply and verify significant design parameters of the modern BWR.

GE's extensive nuclear development program has resulted in successive "generations" of BWR designs, each improving on its predecessor. An example was the design for Jersey Central Power and Light Company's Oyster Creek plant in New Jersey ordered in 1963. Units of this design offered advantages in terms of competitive operating costs as compared to fossil-fueled plants. They standardized on the direct-cycle BWR systems, in which the steam goes directly from the reactor to the turbine, permitting increased reliability and operat-

ing performance by eliminating the complexities of heat-exchange equipment.

New BWR designs made possible the planning of larger-capacity generating plants. One of the General Electric BWRs, for instance, installed at the three-unit Browns Ferry plant of the Tennessee Valley Authority, was the world's first nuclear reactor to generate 1 million kilowatts of electricity in a single unit.

The newest-generation General Electric BWR is the BWR/6 design which was introduced in 1972 and offered the potential for greater product standardization and other advantages.

More recently, GE's nuclear technology scored another important "first" when the General Electric Standard Safety Analysis Report (GESSAR) became the first standard plant design approved by the NRC staff for use in construction permit applications. This approval means that construction permit applications referencing the GESSAR will not require further NRC staff review of the design of the majority of the nuclear plant. The significance of GESSAR is that it represents a step toward meeting the problems of lengthening cycles for licensing reviews and rising construction costs by *standardizing*

licensing criteria for groups of similar plants. Two subsequent approvals further extend the NRC-approved standard nuclear designs offered by General Electric.

A key technical objective of General Electric's management has been to earn for GE nuclear technology a reputation for quality and reliability similar to that enjoyed by the Company's long-established steam turbine-generator products. In 1974 a task force under the leadership of Dr. Charles E. Reed, Senior Vice President—Corporate Technology, undertook a study to assess the resources necessary to achieve this goal. Results of the study are reflected in the Company's engineering and development program in nuclear technology.

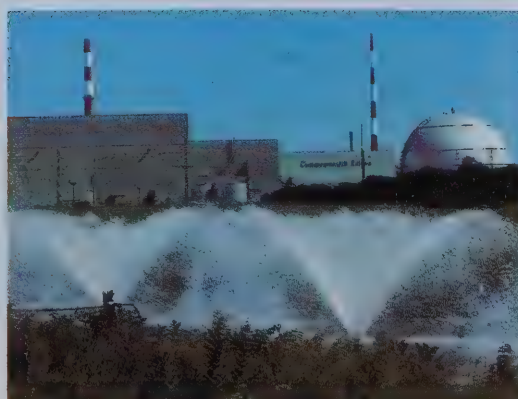
While the task force report specifically states that "this study was not a safety review," it has been characterized incorrectly by some as identifying "27 safety problems" associated with GE reactors. In fact, a review of the completed study in terms of information relating to plant safety found no substantive data that had not previously been reported for review by the U.S. Nuclear Regulatory Commission (NRC).

GE's nuclear business has been devel-

## 1977

**Just twenty years ago this fall the U.S. granted Power Reactor License Number One to a nuclear power plant: GE's Vallecitos boiling water reactor, near Pleasanton, Calif.**

**In 1960, the Dresden 1 plant near Chicago became the first large-scale, privately financed commercial nuclear power plant. Its GE reactor generates 200,000 kilowatts of power.**



**Today, Dresden has been expanded to three GE-equipped nuclear facilities, contributing to a nuclear capacity that enables Commonwealth Edison to meet as much as 50% of the Chicago area's electrical needs with nuclear generation.**

oped on a worldwide basis, as indicated by the fact that GE-type BWRs are operating or on order in 11 countries: Austria, India, Italy, Japan, Mexico, the Netherlands, Spain, Switzerland, Taiwan, the U.S. and West Germany. In accepting international orders, General Electric does so in conformance with U.S. government policies and with the approval of the U.S. Department of Commerce, U.S. nuclear agencies such as the NRC, and the State Department. As a result, the Company's nuclear exports are made only to countries which have signed bilateral nuclear agreements with the U.S.

**Fuel fabrication,** reactor components and nuclear services operations have been developed into substantial businesses by General Electric.

As the first reactor supplier to standardize on Zircaloy-clad nuclear fuel for commercial reactors—eight years ahead of its U.S. competitors—GE continues to hold a wide margin of experience with the fuel cladding that is now the industry standard.

The Company's facility in Wilmington, N.C., is one of the world's largest uranium fuel fabrication plants.

For greater control over the quality of pressure vessels for nuclear generation facilities, General Electric and Chicago Bridge and Iron Co. jointly formed CBI Nuclear to specialize in this technology.

In addition, the Company conducts a substantial service business in the installation and maintenance of nuclear plants. Recognizing utilities' needs for trained nuclear plant operators, as an example, GE in 1968 dedicated in Morris, Ill., the BWR Training Center. To train supervisors and operators for boiling water reactor plants, this facility employs a full-scale, real-time simulator that serves as a functional duplicate of an actual BWR control room.

**Other aspects** of the nuclear power business have been developed by General Electric along with its primary concentration on power reactor and fuel technologies. Among these are the following:

- GE has played a central role from the inception of the U.S. program to develop the breeder reactor, as discussed earlier in this *Investor*.
- The Company has supplied small-scale

research reactors to U.S. customers, primarily universities. In conformance with U.S. nuclear export policies, GE has also supplied research reactors to governments and universities in other countries.

- For the U.S. space exploration program, GE has pioneered exotic power generation devices, including nuclear systems that produce electric power without energy conversion through turbine-generators. Most famous of these devices is the SNAP-27 generator placed on the moon's surface by the Apollo 12 crew to provide a power source for numerous scientific instruments left at the landing site.

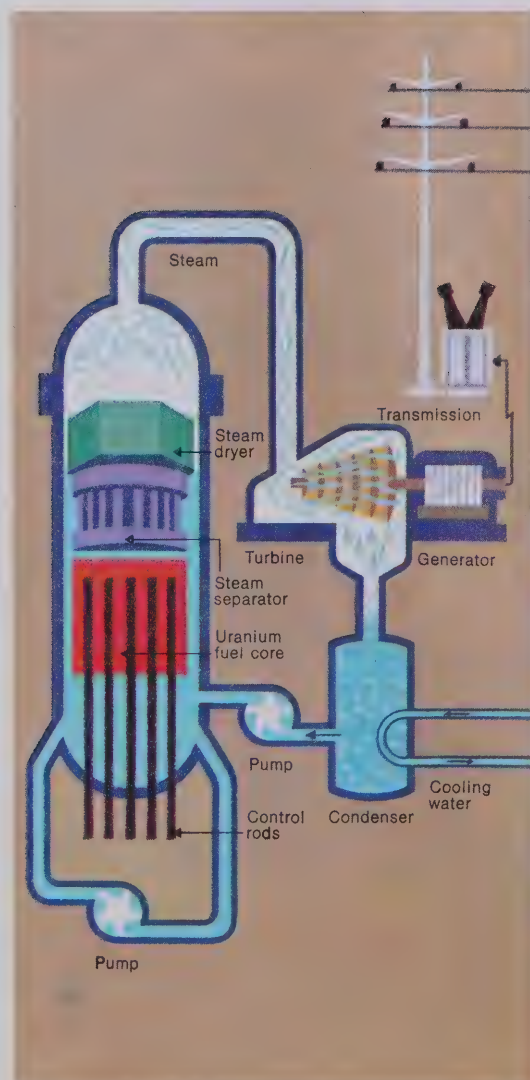
- At Pleasanton, Calif., General Electric operates one of the world's largest private nuclear research laboratories. The laboratory does development work for such external customers as the U.S. Energy Research and Development Administration as well as for General Electric.

As reported previously to share owners, the uranium business of Utah International Inc. was, at the time of Utah's merger with General Electric, transferred to a wholly-owned affiliate whose stock is held by independent voting trustees. However, General Electric does receive dividends from this affiliate's net income.

GE is not otherwise engaged in uranium mining or milling except in a minor way to meet some of its commitments for nuclear fuel. Nor is the Company engaged in fuel enrichment, which continues to be provided entirely by the U.S. government.

To complete the cycle: at Morris, Ill., the Company attempted to develop a pilot plant applying a new approach to the reprocessing of spent nuclear fuel. But it was never put into commercial operation due to problems associated with the facility's unique technology. The Atomic Energy Commission terminated the plant's license and thereafter GE contracts with utilities for reprocessing services were terminated. General Electric is not participating on a commercial basis in nuclear fuel reprocessing, waste disposal or storage, except that the Company is storing some spent fuel at the Morris facility as a convenience to customers whose reprocessing contracts were terminated. General Electric recently applied to the NRC for a license to expand the capacity of this storage facility.

**GE's nuclear business today,** headquartered in San Jose, California, employs some 8,600 people in commercial nuclear research, test, design, development, manufacturing and service. In addition to its



**The GE boiling water reactor is a 'direct cycle' system—which produces steam for the turbine-generator without need for heat-exchange equipment.**

sales of nuclear systems and fuel directly to customers, GE maintains a program of international technology licensing, exchange and development agreements, currently involving Italy, Japan, the Netherlands, Spain, Sweden and West Germany.

Including those built by licensees, a total of 42 GE-type nuclear power units were operational in the U.S. and seven other countries in mid-1977. Their combined generating capacity of 24 million kilowatts is enough electricity for 24 cities the size of San Francisco. These plants included:

- 24 units operating in the U.S., totaling 18 million kilowatts;

- 12 units operating in seven countries outside the U.S., totaling 3 million kilowatts; and
- 6 licensee units operating in two countries, totaling 3 million kilowatts.

These units represented over 40% of the operating units and 40% of the kilowatt-hours generated by all light water reactors in the non-Communist world.

In addition, General Electric's mid-1977 backlog of unfilled orders for nuclear systems and nuclear fuel totaled approximately \$6 billion, including:

- 40 units in the United States; and
- 18 units outside the U.S.

Backlogs of licensees totaled 13 units.

GE's nuclear business operated at a loss in 1976. The Company is spending significant amounts on engineering and development in support of nuclear projects in the backlog. These expenditures, when coupled with the effects of deferments of shipments and cancellations of orders, are likely to result in several years during which the nuclear business will operate at a loss, whereas it had been marginally profitable in recent years. It is management's belief that any such losses will not impact materially on General Electric's profitability.

And, as previously reported, customers have required that nuclear fuel be sold with warranties covering the useful life of the fuel, even though the experience base for predicting the life of nuclear fuel under power plant operating conditions is still relatively small. As of December 31, 1976, there were open warranty commitments on fuel with an original sales value of approximately \$660 million, and on fuel in the backlog valued at that date at \$2.8 billion, covering deliveries through the 1980s.

In addition, fulfillment of a small number of its nuclear fuel orders requires the Company to procure uranium concentrate. GE's maximum uranium concentrate requirements were estimated at December 31, 1976 to total about 27 million pounds, with actual requirements likely to be about 18 million pounds or less. General Electric had on hand or under contract about 20 million pounds. Also, some fuel orders include uranium enrichment, reprocessing, plutonium fabrication and waste disposal services. In view of continuing uncertainties as to government policies regarding key segments of the nuclear fuel cycle, as commented on earlier in this *Investor*, and on-going discussions with customers, the availability and costs of these services are not now determinable.



GE-type BWRs  
as of June 30, 1977

- Operational
- ▲ On order

**At mid-1977, 113 GE-type BWRs were operational or on order in 11 countries.**

# Steps toward energy sufficiency for the U.S.

## Summary



**New Trapper coal mine at Craig, Colo., opened by GE's Utah International natural resources affiliate, will deliver 2½ million tons of steam coal per year for use in electric power generation.**

A meeting in Washington earlier this year provided the occasion for Edward E. Hood, Jr., Vice President and Group Executive of the Power Generation Group, to present GE's views for the energy future to Dr. James R. Schlesinger, who has been named Secretary of the new Department of Energy.

Hood outlined GE's projections of U.S. energy supply and demand in the year 2000 (see page 5), leading to these conclusions:

- "We in the U.S. must conserve and conserve vigorously.
- "Coal and nuclear must contribute about half of the total energy supply in 2000 and most of this must be used in the form of electricity.
- "We must push all our energy options to the outer limits of realism.
- "Despite our best efforts, we will probably still depend on foreign oil in the year 2000. To forgo development of any viable energy option will only aggravate the problem."

The GE officer thus summarized the steps recommended by General Electric to achieve a sufficient supply of energy for the U.S. in the years ahead.

### 1. 'Conserve and conserve vigorously.'

Energy conservation is essential to hold demand to tolerable levels. GE studies indicate that vigorous conservation can help to keep the energy growth rate down to the more manageable future demands discussed on page 5 of this *Investor*.

General Electric's own conservation experience indicates what can be done. GE's conservation efforts date back to 1962. In 1973, the Company's Energy Conservation Council was formed under Hershner Cross, Senior Vice President—Corporate Administrative Staff. The Council directs the efforts of 39 Division energy coordinators who advise GE operations on ways to conserve plant energy. Substantial savings have resulted, both in fuels and in energy resources required to manufacture products. The GE program has been recognized by awards from the U.S. Department of Commerce and the Federal Energy Administration.

### 2. Manage the shift to coal.

Because of its huge reserves, the United States has been called "the Saudi Arabia of coal." Yet coal has been accounting for smaller percentages of total United States energy consumption than in the past—the present 18% is less than half coal's share 20 years ago.

General Electric is contributing in several key ways to the present U.S. drive to shift from imported oil to domestic coal:

- Utah International Inc., GE's natural resources affiliate, produces steam coal at its New Mexico and Colorado surface mines.
- General Electric manufactures motors, controls and other products for mining equipment, as well as steam turbine-generators and other power plant equipment for coal-fired electric power plants.



**Clean-burning gas from coal is the objective of major coal gasification project at GE's Research and Development Center.**



**New vacuum tube solar collectors represent one phase of General Electric's developmental work on solar heating.**

- The Company's research and development programs include substantial projects aimed at improving coal technology and identifying viable coal-based power generation alternatives.

As with nuclear energy, GE experts see the need for fundamental changes in U.S. direction if a large-scale shift to coal is to be realized. Charles K. McArthur, Senior Vice President of Utah and the affiliate's Manager—Mining Division, comments:

"The conditions are not now in place for a coal growth scenario like that proposed by U.S. government energy officials. The multiple, conflicting permits necessary to open a new mine can take more time than the construction of the mine. In addition, there are not nearly enough rail lines, rail cars, barges or slurry pipelines to carry the projected coal tonnages. Growth at that rate will require the hiring and training of some 60,000 new miners and mine managers by 1985. Present limitations on coal production and use make it unlikely that the industry can command that scale of capital and other resources."

Renewed emphasis on coal should, in GE's view, be joined with incentives for the optimum production of domestic oil and gas and development of shale oil resources.

### **3. Push alternative energy options.**

The energy challenge facing the U.S. is too serious, GE experts believe, to allow deferring development of any viable energy option. The Company backs up this belief by building its expertise in virtually all advanced energy technologies and by investing in those that offer reasonable expectations of success within a reasonable time period. Examples show the range of current GE energy development projects:

- **Advanced coal technologies.** In addition to the major project in coal gasification pictured above at left, the GE Research and Development Center is at work on ultra-high-temperature gas turbines that, in combined-cycle steam-and-gas turbine plants, will utilize low-BTU gas from coal. These plants are expected to be highly efficient generators of electricity.

In another project, the R&D Center is exploring magnetic methods of removing sulfur from coal before burning—a project that, if successful, could eliminate the need for stack-gas "scrubbers" that are expensive and produce large amounts of solid waste.

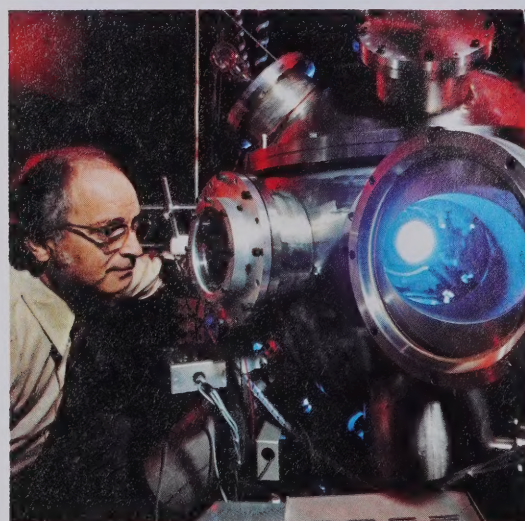
- **Solar.** The advanced vacuum tube solar collectors illustrated at lower left represent one phase of General Electric's developmental work on solar heating. Longer-range research is underway to utilize photosynthesis involving sunlight and living organisms to generate hydrogen for fuel directly from sunlight in much the same way green plants generate oxygen.

- **Wind power.** General Electric's Space Division is building two 1½-megawatt wind turbines under a contract from ERDA and the National Aeronautics and Space Administration. With average wind speeds of 18 mph, the windmills are expected to produce enough energy annually to supply more than 500 homes.

- **Geothermal.** GE's Medium Steam Turbine Department, which



**World's largest geothermal-powered steam turbine-generator is a GE 135,000-kilowatt unit supplied to the Geysers Power Plant north of San Francisco.**



**Large fusion project at the University of Rochester, in which GE is participating, seeks to emulate the sun's energy-producing process. A significant role for fusion in energy production is not expected until well into the next century.**

supplied turbine-generators for the geothermal plant pictured, is actively exploring further marketing opportunities in harnessing underground steam for power generation.

- **Magnetohydrodynamics (MHD).** This technology, in which electricity is generated by passing a flow of ionized gas at high speed through a magnetic field, continues to be investigated by General Electric. MHD offers long-term promise of highly efficient electrical generation.

#### **4. Reinvigorate nuclear power.**

In his Washington meeting, GE's Ed Hood found Dr. Schlesinger in substantial agreement on the need for nuclear energy, as indicated by his subsequent announcement of the necessity for the United States to build 300 additional nuclear generation facilities by the year 2000.

Hood voiced concern as to whether the U.S. will sustain the productive capability to produce this volume of nuclear plants. Citing the present legal, political and regulatory uncertainties that have brought the nuclear industry to a standstill, he commented: "Nuclear power is at a crossroads. We can go forward and benefit from over two decades of national effort, or we can permit the disintegration of the existing capability."

Because of serious gaps in nuclear suppliers' future workloads, he explained, "the industrial capability required to sustain the nuclear option is in poor shape now and is likely to deteriorate further."

The GE officer emphasized that he was not threatening that General Electric would go out of the nuclear reactor business. "We have nearly 60 nuclear plants on order," he said. "We fully intend to meet these commitments and provide the continuing support necessary to assure that all of our plants operate reliably and safely."

The objective of the meeting was, instead, to present "a candid appraisal of the situation so that U.S. energy planning could be based on realistic assumptions—not illusions."

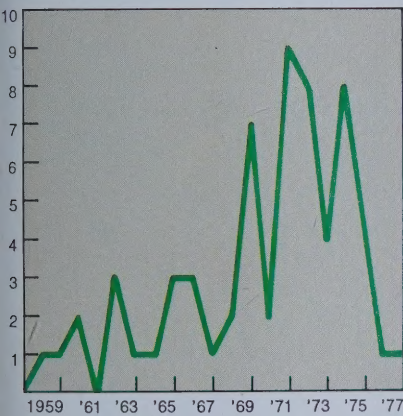
While nuclear services and fuel fabrication are expected to remain viable businesses, Hood said, there are serious questions as to whether manufacturers can continue to supply nuclear reactor systems "unless the business can be conducted on a very different basis in the future."

The GE officer completed the meeting by making a number of specific suggestions for government action aimed at reinvigorating the nuclear industry:

- **Regulatory reform.** "The regulatory climate has worsened at an accelerating rate since the late 1960s," he reported. "Unless the whole process is radically reformed, major new commitments to nuclear plants are not likely to be made."

He called for a resolution of present overlapping controls between federal agencies—for example, the role of the Nuclear Regulatory Commission and the Environmental Protection Agency in establishing radiation exposure limits. Similarly, interactions be-

### U.S. reactor orders abroad



**Decline in orders placed on U.S. suppliers of nuclear power reactors largely reflects customers' uncertainties about U.S. export policies.**

tween federal and state agencies need to be more clearly defined.

Limitations must be placed, he believes, on the role of intervenors "so that a better balance is obtained between the legitimate need to raise objections and the opportunities for endless delays."

- **Nuclear waste disposal.** This has been one of the major targets of the opponents of nuclear power, Hood observed. "To remove this as an issue, it is essential that the government face up to its responsibilities for the storage of high-level wastes, with or without reprocessing in the near term. What is needed is a policy that can be relied upon for planning purposes."

- **Proliferation and export policy.** "The uncertainties regarding nuclear exports must be resolved. The viability of U.S. manufacturers will, in part, be a function of their ability to participate in the export market. This is severely hampered at present by foreign concerns over government roadblocks to U.S. exports, particularly when contrasted with the more supportive policies of the governments of our French and German competitors."

- **The breeder reactor program.** "We urge that the breeder development be continued. As we see it, the breeder represents the only assured large new energy source for the 21st century."

Hood ended the Washington meeting by reiterating GE's belief that "increased use of nuclear power is essential to the solution of the nation's energy problem, and GE will make every reasonable effort to contribute to that end."

**For more information:** Because of space limitations, the coverage of nuclear issues in this General Electric *Investor* is a condensation of more complete analyses and statements by energy and nuclear experts. For the same reason, it has been necessary to omit references and documentation for many of the statistics and facts included. Share owners who wish more information, or the sources of specific data, are invited to write to Investor Relations, General Electric Co., Fairfield, CT 06431.

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**Editor:** Frederick N. Robinson

**Associate Editors:** Devere E. Logan; Edna Vercini

**Editorial Board:** Douglas S. Moore, Vice President—Corporate Public Relations; David W. Burke, Manager, Corporate Communications; J. Hervie Haufler, Manager, Corporate Editorial Programs; John L. Ingersoll, Manager, Corporate Institutional Relations

**Art Direction:** Jack Hough and Associates, Inc.

**Cover:** Nick Fasciano

**Illustrations:** Howard Koslow

**Photographers:** Chris Anderson, Stan Blanchard, Walter B. Halstead, Tony Kelly, Edward H. Morgan, Jr., Fujio Nakahashi

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